THE PTERIDOPHYTA OF TAIWAN-5 HYMENOPHYLLACEAE: TRICHOMANES[1]

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In 1906 Matsumura and Hayata listed 20 species of the Hymenophyllaceae from Formosa (1906: 564–569). In 1936 Masamune listed 32 species in his Short Flora of Formosa (1936: 1–3), and in 1954 he listed 44 species in his mimeographed paper on "A list of vascular plants of Taiwan" (1954: 4–5).

Copeland (1947: 30–42) divided this family into 31 genera and according to his classification we would have representatives from 15 of them. Many have followed Copeland in accepting these 31 divisions as genera, others much prefer to place nearly all the filmy ferns in the two well known genera: *Hymenophyllum* and *Trichomanes*. (Christensen, 1906: 356–370, 634–652; Nakai, 1926: 239–270.)

This year Morton (1968: 153–214) published a paper on the Hymenophyllaceae and recognized six genera in this family, reducing the other names to subgenera or sections of subgenera. All of our Taiwan species would fall either in the genera *Hymenophyllum* or *Trichomanes*.

Many of these ferns have been beautifully illustrated by van den Bosch (1861), and in Copeland's works (1933: 119–280; 1937: 1–188; 1938: 1–110). T. Ito gave photographs of 16 of the Taiwan species in his Zuku Taiwan shokubritsu dzusetsu (1928). Ogata illustrated 21 species in his Icones Filicum Japoniae. Our artist, Mr. C. C. Chen (陳建籌), has prepared 12 illustrations. Each of his drawings is based on Taiwan specimens. Dr. Su-hwa (Tsai) Chiang (江蔡淑華) of our Department has taken microphotographs of a number of the species to better illustrate their cellular anatomy.

The Hymenophyllaceae are a very unique family. Some of these beautiful little ferns are very small, being only about 1 cm tall, many are seldom seen as they grow in inconspicuous places. The gametophytes are very different than in other families. Many species have no roots. Most species have long creeping rhizomes, and usually these are covered with dark brown multicellular hairs. A few species have very short stems with tufted leaves, and these have long fibrous roots. Most species have leaves that are only one cell thick except at the midrib.

Since the fronds are usually only one cell thick, it is sometimes possible to separate species and even genera on the basis of cell shape and cell wall structure. In order to see the leaf anatomy more clearly, the leaves of each species have been cleared and made into permenant slides. In 1964 Ngok-Hung Poon (潘吾雄),

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of our department, made a study of the leaf anatomy of 22 species, using a modification of Foster's method (1949: 216–217). This year Misses Yu-Hsia Chen (陳玉霞) Su Huang (黃蘇) Yu-Jen Shih (石玉仁) and Mr. Wu-Chang Tseng (鄭武燦) prepared slides of the leaves of nearly all of our Taiwan filmy ferns. These followed Esau's method for clearing leaves for microscopic examination.

In this paper, following the description of each species, is given a description of the leaf anatomy as seen in cleared specimens. The most striking observation gained from this study is the nature of the cells in the veins and false veins. Of the twelve genera of the *Trichomanes* studied, nine have brachysclereids, i.e. cells which have very thick walls and almost square ends (Pl. 9 fig 12). These are arranged in long rows. In some genera they are in single rows, in others they are in parallel rows. The lumen of these sclereids may be round or almost obliterated and existing only as a cresent-shaped line. There are three genera (*Callistopteris*, *Pleuromanes*, *Microtrichomanes*) which lack these sclereids. In their place *Callistopteris* and *Pleuromanes* have large long sclerenchyma cells with simple pits (Pl. 3 fig 12 and Pl. 11 fig 12). *Microtrichomanes* differs from all others in having veins with long fiber-like cells with narrow lumen. (Pl. 10 fig 12) Some of the genera that have the brachysclereids in their veins also have the long pitted sclerenchyma cells similar to those found in *Callistopteris* and *Pleuromanes*.

In all of the species studied to date, we have found 2 or more small spiral tracheids in the center of the midrib and true veins.

Boodle (1900: 455–496) studied the anatomy of the root and rhizome of a number of species of the Hymenophyllaceae and reported their structure as seen in the cross section of these organs. He noted quite a range of patterns in the stele. His plates were well prepared. In our study we have not yet studied the anatomy of the rhizome of the Taiwan *Trichomanes*, but this needs to be done. For vascular anatomy often is of much value in determining plant relationships. Some of the species studied by Boodle also grow in Taiwan.

Copeland referred to some species as having laminar cells with pitted walls, he evidently did not use this term "pitted" to mean pits in the sense that we generally use it in plant anatomy. He seemed to be referring to laminar cells with very uneven walls; this situation exists in several species, especially in *Selenodesmium*. And Copeland says (1933: 258) that "the walls (of *Abrodictyum*) are thickened and pitted in a manner suggesting the group of *T. rigidum*". He also says that, "The pitting of the walls (in Abrodictyum) escaped van den Bosch; (and says) he may have figured a Tidore specimen, and it may be absent there". Our Taiwan specimens do not show this scalloped character, (Pl. 4 fig 11) and agree with van den Bosch's observations. (Pl. 13 fig 2)

This study is far from complete but if I waited until it was complete, I might never publish it. Several unexpected finds in the past few days will require weeks

or months of research to resolve. The gametophytes of some do not fit into the pattern usually expected.

I am using the small genera of the Hymenophyllaceae since they break this large family into small well known and easily recognized groups. I have not followed Morton because I feel some of our plants do not fit into his classification very well. For example, according to his key to the subgenera of *Trichomanes* (1968: 178) he separates **Subg. 1. Trichomanes** from **Subg. 2. Pachychaetum** by "rhizomes wide-creeping and fronds distant"; from "rhizomes erect or short creeping, the fronds somewhat clustered". Then he places *Abrodictyum* under the 1st subgenus rather than the 2nd. All specimens of this genus that I have seen have short erect rhizomes with clustered fronds. However he is correct in saying that this is an epiphyte. I do not know the Hymenophyllaceae of the world well enough to undertake to make any rearrangement of Morton's work and so for the present I am not trying to fit our plants into his system. When we learn a bit more about the plant anatomy, and the gametophytes of our oriental species we may be able to fit our Taiwan plants into a system like that which he has proposed.

Morton considers the generic name *Vandenboshia* superfluous (1968: 178) and says that the genus name *Trichomanes* should be used "by those who wish to continue to split up the Hymenophyllaceae into smaller genera". The difficulty is that according to Morton the subgenus *Trichomanes* has eight sections, and embraces a very large and diverse group. Even Morton's **Section 1. Trichomanes** under **Subg. 1. Trichomanes** (1968: 178) refers to fronds that have ciliate margins and come from the West Indies. Those placed by Copeland in *Vandenboschia* fall in **Section 2 Lacosteopis** under Morton's system. And to use the genus name *Trichomanes* for only this section of *Trichomanes* would not seem advisable; so I am using the name *Vandenboschia* for this small section of the large genus *Trichomanes* as it is a well known name for these oriental ferns.

A Key to the Trichomanes of Taiwan based largely on Anatomical Characters of the Leaf.(1)

1. Veins and false veins without brachysclereids..... 2
1. Veins and false veins containing brachysclereids..... 4
2. Veins containing large, pitted, sclerenchyma cells 3
2. Veins containing long fiber-like cells; herbarium specimens with very dark brown leaves.....*Microtrichomanes*
3. Leaves with a single submarginal row of thick-walled cells, which stain deeply with safranin; laminar cells oblong with thin pitted walls; marginal row of cells linear, walls thin, very narrow; blade covered with linear, unicellular, yellow hairs .....*Pleuromanes*

(1) As seen in cleared specimens.

3. Leaves without a row of deep staining submarginal cells; laminar cells polyhedral, walls thin; stipe and rachis covered with long, stiff, multicellular dark-brown hairs.....*Callistopteris*
4. Fronds with false veins..... 5
4. Fronds without false veins.....12
5. Fronds with submarginal veins 6
5. Fronds without submarginal veins..... 9
6. Submarginal vein continuous..... 7
6. Submarginal vein interrupted, other false veins (striae) present.....*Crepidomanes bilabiatum*
7. Fronds pinnately or palmately divided; other false veins usually absent 8
7. Fronds simple, ovate to obovate; midrib giving off lateral veins; false veins occur between the true ones.....*Microgonium bimarginatum*
8. Fronds sessile.....*Crepidomanes latemarginale*
8. Stipe nearly as long as blade.....*Crepidomanes nanophyllum*
9. With false veins between the true veins; fronds bearing long brownish non-septate hairs along the veins, especially at base of fronds.....10
9. Without false veins between the true veins, but with short scattered striae.....11
10. Fronds petiolate.....*Microgonium bimarginatum*
10. Fronds sessile .....*M. beccarianum*
11. Fronds 3–15 cm tall.....*Crepidomanes late-alatum*
11. Dwarf species.....*C. palmifolium*
12. Marginal cells specialized.....13
12. Marginal cells not specialized.....16
13. Marginal cells elongated; laminar cells polyhedral.....14
13. Marginal cells polyhedral; laminar cells elongated, transverse to long axis.....*Abrodictyum*
14. Marginal cells and often one row of submarginal cells with thicker walls than laminar cells 15
14. Marginal cell walls not much thicker but staining darker .....*Vandenboschia pyxidifera*
15. Radial walls of marginal cells perpendicular or nearly perpendicular to margin .....*V. latifrons*
15. Radial walls of marginal cells very oblique.....*Crepidophyllum*
16. Laminar cells with wavy walls.....*Cephalomanes*
16. Laminar cells without wavy walls.....17
17. Laminar cells with thick very jagged and irregular walls.....*Selenodesmium*

Table 1. Some Important Characters

	Stem short fronds tufted	Rhizome creeping fronds distant	Brachysclereids in veins & false veins	Pitted sclerenchyma cells in veins	Fiber-like cells in veins	Submarginal false veins	With other false veins	Marginal cells specialized	Cell walls thickened-smooth	Cell walls thickened-jagged	Cell walls wavy	Cell walls thin, straight	Laminar cells transverse	Bristles on stipes	Glandular clavate hairs on veins	Lamina hairy	Hairy on midrib and/or veins
Selenodesmium	+		+	+						+				+	+		
Cephalomanes	+		+								+			+			
Callistopteris	+		−	+								+		+			
Nesopteris	+		+	+								+			+		
Abrodictyum	+		+					(4)	+				+	+(5)			
Crepidomanes		+	+			±(3)	±(3)					+			+		
Crepidophyllum		+	+					+				+			+		
Microgonium		±(1)	+			±(3)	+					+					+
Gonocormus		+	+									(6)			+		
Microtrichomanes		+	−		+							+		(5)			
Pleuromanes		+	−	+								+				+	+
Vandenboschia		+	+	±(2)								+			±(3)		

(1) Rhizome creeping, but fronds crowded, often overlapping.

(2) *V. latifrons* and *V. pyxidifera* do not have pitted sclerenchyma cells in their veins.

(3) Some species have; others do not.

(4) Marginal cells differ in shape but not in cell wall character.

(5) Stipe with soft multicellular hairs.

(6) Walls slightly thickened, somewhat warty.

17. Laminar cell walls thin 18
18. Fronds dichotomously forking; laminar cells thin but slightly warty ..... *Gonocormus*
18. Fronds bipinnatifid to tripinnatifid 19
19. Rhizome short; fronds tufted ..... *Nesopteris*
19. Rhizome creeping; fronds distant ..... *Vandenboschia*

It should be borne in mind that the preceding chart was based on characters observed from species growing in Taiwan. It may be that not all species that have been assigned by Copeland and others to these genera show the same characters.

A Key to the Genera of Hymenophyllaceae of Taiwan largely based on Morphological Characters

1. Fronds tufted or approximate, roots fibrous, indusia tubular, receptacle exserted 2
1. Fronds distant 6
2. Small epiphytes; fronds lanceolate, bipinnatifid; laminar cells transversely elongate ..... 1. *Abrodictyum*
2. Terrestrial ferns, laminar cells not transversely elongate 3
3. Fronds pinnate; pinnae margins dentate ..... 3. *Cephalomanes*
3. Fronds bipinnatifid to 4-pinnatifid 4
4. Stipe and rachis without long multicellular hairs ..... 12. *Nesopteris*
4. Stipe and rachis bearing long multicellular hairs 5
5. Fronds 4-pinnatifid, finely dissected, with only one vein per ultimate segment ..... 2. *Callistopteris*
5. Fronds tripinnatifid, not finely cut to base, pinnules with forking veins ..... 14. *Selenodesmium*
6. Indusia tubular or conical, if mouth is 2-lipped, not cleft to base 7
6. Indusia 2-lipped, cleft to base 14
7. Fronds with specialized marginal cells or with false veins (either occuring in a submarginal line, as false veins between true ones or as scattered short striae) 8
7. Fronds without specialized marginal cells or false veins 11
8. Marginal cells differing from laminar cells 9
8. Without specialized marginal cells, but with false veins 10
9. Radial walls of marginal cells nearly perpendicular to the margin ..... *Vandenboschia latifrons*
9. Radial walls of marginal cells very oblique ..... *Crepidophyllum*
10. Fronds digitately or pinnately divided, with submarginal false veins or short striae ..... 4. *Crepidomanes*

10. Fronds simple, ovate, obovate, or orbicular (not digitately or pinnately divided); with false veins between the true veins.....10. *Microgonium*
11. Fronds digitately and dichotomously lobed.....12
11. Fronds pinnatifid to 4–pinnatifid 13
12. Fronds fan-shaped, upper margin deeply cleft but not dissected to base, lamina less than 1 cm long; stipes about as long as blade; indusia tubular, mouth much enlarged.....6. *Conocormus*
12. Fronds dissected to base; lamina 1.5 to 2 cm long; stipes much longer than blade; indusia with short cone-like tube, mouth deeply undulate or somewhat 2–lipped .....11. *Microtrichomanes*
13. Lamina covered with long brown hairs .....13. *Pleuromanes*
13. Lamina not covered with long hairs.....15. *Vandenboschia*
14. Margins of fronds and lips of indusia entire .....8. *Mecodium*
14. Margins of fronds toothed 15
15. Receptacle exserted.....9. *Meringium*
15. Receptacle included.....: .....7. *Hymenophyllum*

1. **Selenodesmium** (Prantl) Copeland
長筒蕨屬 Chang T'ong Chüeh Shu
Copeland, 1938:80; 1958:79.

Terrestrial ferns with short creeping to erect rhizomes, rhizomes and at least basal portion of stipes covered with stiff multicellular hairs; blades ovate, bipinnatifid to tripinnatifid; stipes tufted or approximate; roots fibrous; laminar cells thickened and inner margin of cells very irregular, often spinulose; indusia tubular, mouth entire, 2–lipped and or notched.

1. Selenodesmium obscurum (Bl.) Copeland **Plate 1**

Copeland, 1938:81; 1958:79; H. Ito, 1944 pl 481; Ohwi, 1965:36; Ching, 1959:191.

Trichomanes obscurum Bl.

Blume 1828:227; v.d. Bosch, 1861:23 pl 17; Copeland, 1933:233 pl. 43, 44; Holttum, 1954:108.

T. rigidum (non Sw.) Hooker sensu Makino, 1898:193; Matsumura and Hayata, 1906:568; Yabe, 1905:35; Hayata 1914 (4): 140 fig. 79; T. Ito, 1928 pl. 394; Ogata, 1931 vol. 4 pl. 200.

T. cupressoides Desv. sensu Nakai, 1926:260.

Terrestrial ferns; rhizome short, stout, erect or somewhat creeping covered with stiff, dark brown, multicellular hairs; roots fibrous, long; stipes 5–12 cm long, usually tufted, or approximate and 2–3 mm apart; stipe covered with the same type of dark brown, multicellular, shiny hairs as are on the rhizome; rachis bearing many septate, clavate, glandular hairs on underside; roots 5–15 cm long, fibrous;

Plate 1. Selenodesmium obscurum (Bl.) Copel. Kankou, Taipei Co., *DeVol 9052*.

fronds ovate, texture firm, tripinnatifid; living plants dark green, herbarium specimens blackish; pinnae approximate, tending to curl when dry; lower pinnae sometimes shortened; veins forking, free; sori borne on acroscopic margin of pinnae; indusia tubular, narrowly winged; mouth often 2-lipped, more or less notched; receptacle very long exserted. In the living plant the sori are bent back nearly 90°, so that although the sori are marginal, their mouths do not point toward the apex but toward the back of the frond.

Cellular structure: Laminar cells irregular or arranged in parallel rows, more or less rectangular in shape, with their cell walls somewhat thickened and the inner walls very irregular, being almost spinulose. Copeland refers to this type of cell walls as being "pitted", however they are not pitted in the sense that tracheids and sclerenchyma cells are pitted. Veins contain spiral tracheids and rows of brachysclereids with small round or cresent-shaped lumen.

Distribution: Ceylon, South India, Malaya, Thailand, Indonesia, Philippines, Formosa, Ryukyu, Micronesia.

Taiwan:

Taipei Co., Wulai, *T. Suzuki 19381*; Mushan, *T. Suzuki 13864*; Ayu, *Kao 30043*; Kankou, *Kao 3708*; *W. T. Cheng 374*; *DeVol 9052*.
Ilan Co., Mt. Bon-bon, *Kao 5963*; Tsien-shan-hu, *T. Ito 101*.
Hwalien Co., Chingshui Shan, *T. Nakamura 3572*.
Pingtung Co., Nan-rin-shan, *S. Sasaki* Mar. 27, 1932.
Orchid Island, *Shieh* and *Chen*, X-13-1967.(1)
Nantou Co., Meiyuan, *S. Sasaki 52*; Lien-hwa-chih, *T. F. Chen 1321*.

Habitat: Growing on shaded forest slopes.

Note: Copeland distinguished *T. obscurum* from *T. cupressoides* (1933: 233-237, 242-243) in that the stipe of *T. obscurum* was terete and that of *T. cupressoides* was sulcate, also he noted that the tips of the pinnae are more inclined to curl in the former. Ching (1959) says that we have both species on Taiwan and distinguishes these by a number of others characters such as whether the indusia is 2-lipped or notched and whether the rachis is glabrous or pubescent etc.

Most of the specimens from Taiwan which we have examined have terete stipes and rachises, but some have sulcate stipes. However there seems to be no correlation with such other characters as to whether the rachis is winged to its base, indusia is 2-lipped or toothed, etc. Judging from what we have seen *T. cupressoides* cannot be distinguished from *T. obscurum*.

There is considerable difference in size between the small plants and large ones, but the small ones often bear sori.

(1) All specimens collected by Shieh and Chen from Orchid Island and Nantou Co., were very small not exceeding 7 cm tall, many were fertile.

2. **Cephalomanes** Presl

厚葉蕨屬 Hou Yeh Chüeh Shu

Copeland, 1933: 345–257; 1938: 66–68; 1947:40.

A genus of terrestrial ferns with erect or semi-erect rhizomes bearing long fibrous roots; stipes tufted, covered with stiff, long, dark-brown, multicellular hairs; fronds usually simply pinnate; indusia tubular; receptacle exserted; cell walls wavy, veins with very thick walled brachysclereids.

1. C. javanicum (Bl.) v. d. B. **Plate 2**

van den Bosch, 1861:30, pl. 22; Copeland, 1938:67; H. Ito, 1944 pl. 480; Ching 1959:189; pl. 14 figs. 1–4.

Trichomanes javanicum Bl.

Blume, 1828:224; Hooker, 1862: pl. 37. Rosenburgh, v. A. v. 1908:100, 799; T. Ito, 1928:396, pl. Copeland, 1933:246 pl. 52 fig. 1; Ogata 1935 (6): pl. 297; Holttum, 1954: 102; Matsumura and Hayata, 1906:565.

C. oblongifolium Presl

Presl, 1851:19 pl. 10; Copeland, 1938:67; 1958:78; Masamune, 1954:5.

T. asplenoides Presl

Presl 1843:129; Copeland, 1933:249. pl. 52 fig. 2; pl. 55 fig. 1.

C. acranthum (H. Ito) Tagawa 1950:45

T. acranthum H. Ito

H. Ito in Nakai, 1937: 109–110 pl. 45. Type from Iriomote Island.

Stipes tufted, 5–8 cm long, covered with dark brown multicellular hairs; fronds pinnate, lanceolate, 15–25 cm long (including stipe); pinnae nearly sessile, 1.5–2 cm long, unequal sided at base and cuneate, apex obtuse, margin dentate; veins oblique, once or twice forked, closely spaced; sori borne on the apex of pinnae and near the apex; indusia tubular, truncate (mouth not expanded); receptacle exserted.

Cellular structure: Cell walls wavy; (Pl. 2. Fig. 11.) veins with 2 central strands of small spiral tracheids and 2 parallel rows of large brachysclereids, lumen nearly obliterated, crescent-shaped; cells bordering the veins long and of thin walls. Pl. 13 Fig. 3.

Distribution: Burma, Malaya, Thailand, Philippines, Indonesia, Polynesia, Okinawa, Taiwan.

Taiwan:

Orchid Island: *T. S. Liu 398, Chuang* and *Hsu 2451, Hsu, 9025, T. Hosakawa 9888, S. Sasaki* VI. 3. 1926; *Shieh 411.*

3. **Callistopteris** Copel.

毛桿蕨屬 Mao Kan Chüeh Shu

Copeland, 1938:64; and 1947:40.

Terrestrial or epiphytic ferns; rhizome erect or suberect; roots stout, fibrous;

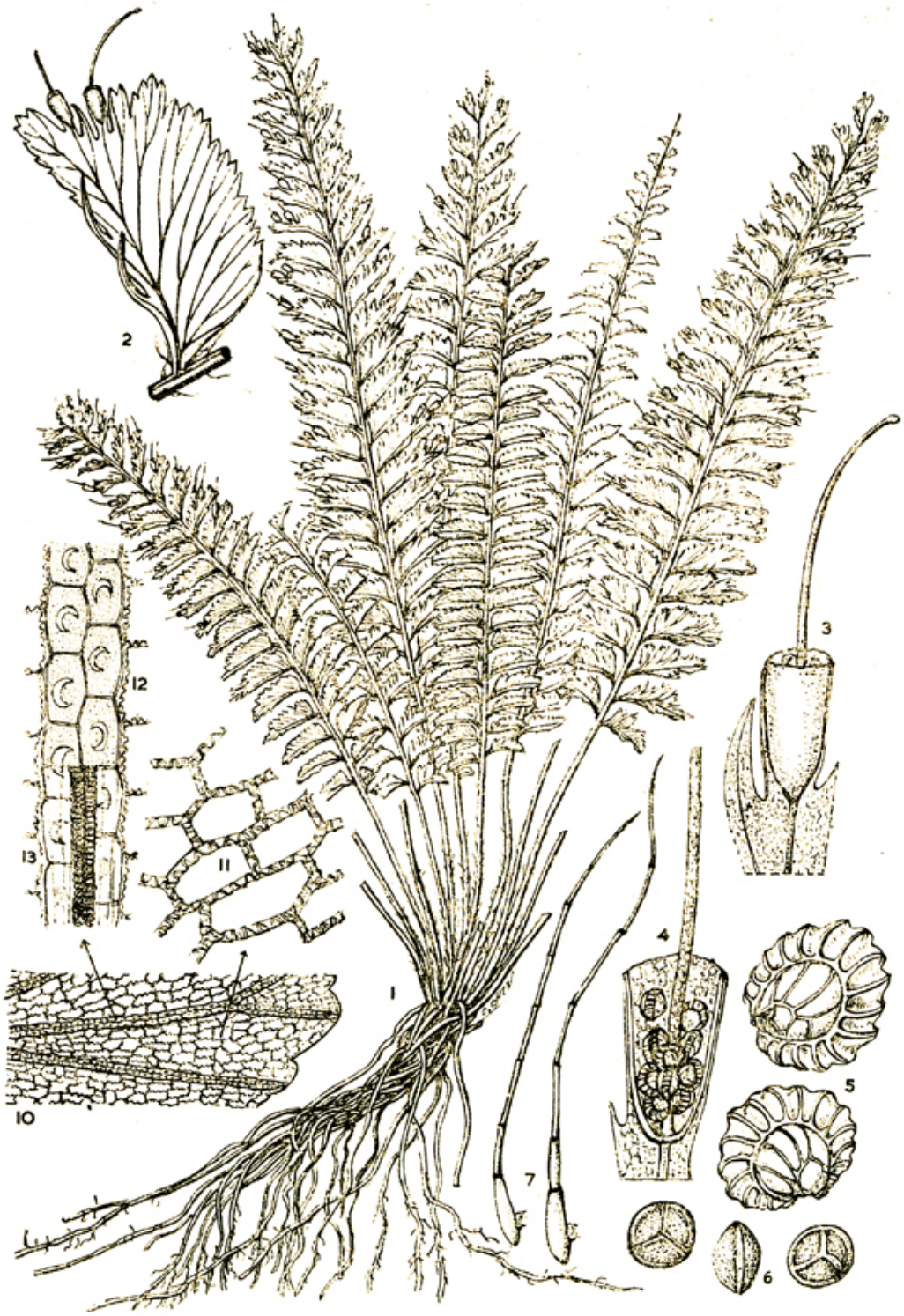

Plate 2. Cephalomones javanicum (Bl.) v. d. B. Orchid Island, *Chuang* and *Hsu 2451*.

stipes caespitose, terete, covered with stiff bristles; fronds large, thin, 4–pinnatifid; cell walls very thin, veins having small spiral tracheids and long pitted sclerenchyma cells with wide lumen.

1. C. apiifolia (Pr.) Copel. **Plate 3**

Copeland, 1938:65; 1958:75; H. Ito, 1944 pl. 478; Iwatsuki, 1958:166; Ching, 1959:194.

Trichomanes apiifolium Pr.

Presl 1843:136; van den Bosch, 1861:26 pl. 19; Copeland, 1933:227 pl. 42; fig. 1.

T. bauerianum Endl. sensu Ogata.

Ogata 1935, 6: pl. 294, Ogata 1935a:36 pl. 5.

Callistopteris baueriania (Endl.) sensu Masamune 1954:5.

Usually terrestrial, growing on damp shaded soil; rhizome stout, erect or ascending; roots stout, fibrous; stipes caespitose, 8–12 cm long, brown, covered with

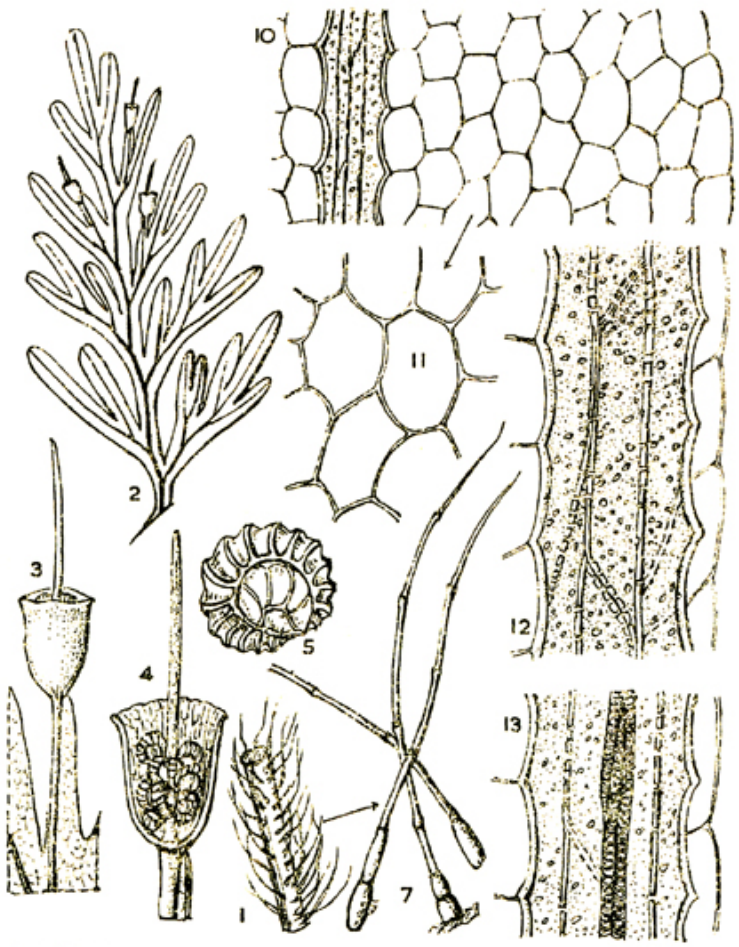

Plate 3. Callistopteris apiifolia (Pr.) Copel. Mt. Bonbon, Ilan Co., *Kao 5964*.

stiff, dark brown, horizontal bristles up to 5 mm long or longer; fronds usually 4-pinnatifid, 20–50 cm long (including stipe); pinnae widely spreading, 6 to 9 cm long; ultimate segments linear; with only one vein per segment; basal pairs of pinnae usually shortened; rachis narrowly winged, also bearing the horizontal bristles; sori borne on the acroscopic branches of pinnules; indusia tubular, very narrowly winged, truncate at apex; receptacle long exserted.

Cellular structure: Cells polyhedral, nearly isodiametric, walls straight, very thin; veins with 2–4 rows of spiral tracheids in the center, bounded by large long sclerenchyma cells with pointed ends and wide lumen, walls covered with simple pits (Pl. 3. Fig. 12.); veins bordered on either side with a single row of long thin walled cells. (Pl. 13, Fig. 3).

Distribution: Japan, Taiwan, Philippines, Malaysia, Indonesia, Polynesia.

Taiwan:

Taipei Co., Wulai, *T. Suzuki 19384*; Kankou, *S. Sasaki* XI-6-1932; *T. Shimizu* and *M. T. Kao 12352.*

Ilan Co., Mt. Bon bon, *Kao 5972.*

Hualien Co., Ching-shui-shan, *T. Shimizu* and *M. T. Kao 11667*; Taroko, *S. Sasaki* VI-15-1933.

Taitung Co., Ching-shui-yin, *H. Simizu 3711, Chuang* et all *3452*; Mt. Lamalamani, *M. T. Kao 6872*; Hsinkang, *T. Suzuki 19738.*

Nantou Co., Chitou, *Huang 1433.*

Habitat: Terrestrial, growing on dense forest floors.

4. Nesopteris

球桿毛蕨屬 C'hiu Kan Mao Chüeh Shu

Copeland, 1938:65; 1947:40; 1958:76.

Terrestrial ferns; rhizome erect, very short; roots fibrous, long, covered with short, dark brown, stiff hairs; stipes tufted, very narrowly winged; fronds decompound, ultimate segments very narrow; rachis narrowly winged; bearing club-shaped glandular hairs on lower surface; indusia tubular, winged.

Key to species.

Mouth of indusia not enlarged, ciliate on margin .....1. *N. thysanostoma*
Mouth of indusia more or less dilated, without hairs on its margin....2. *N. grandis*

1. **Nesopteris thysanostoma** (Makino) Copel.

Copeland, 1938:66; 1958:77; H. Ito, 1944: pl. 479; Masamune, 1954:5.

Trichomanes thysanostomum Makino

Makino, 1898:193; 1899:46; Yabe, 1902:47; Ogata, 1936, **7** pl. 348; H. Ito, 1938: 584; Matsumura and Hayata, 1906:568.

T. blepharistomum Copeland

Copeland, 1933:225, pl. 41; Tagawa, 1951:186.

T. maximum Bl. sensu T. Ito, 1928: pl. 393.

Stipes 7 to 20 cm long; fronds 4-pinnatifid; rachis very narrowly winged; ultimate segments linear, 0.5 mm wide; wide; with clavate, glandular hairs on under side of veins; lateral pinnae 5 to 6 cm long; lower ones shortened; indusia tubular, winged, mouth not dilated, with clavate hairs on its margin; receptacle exserted.

Very similar to *T. grande* but differs in that its indusia is tubular, mouth truncate, not dilated, bearing deciduous clavate hairs on its margin.

Nesopteris grandis Copel. has been reported from Taiwan but we have no collections of it in our herbarium.

Cellular structure: Cells small, walls very thin, straight or slightly curved; veins usually with 2 rows of brachysclereids, lumen very narrow, crescent-shaped.

Distribution: Philippines, Taiwan, Ryukyu.

Taiwan:

Orchid Island, Kōtoshō, *K. Miyake*, 1899; *Kawakami*. VII. 1912; *Shieh 424*.

5. **Abrodictyum** Presl

長片蕨屬 Chang P'ien Chüeh Shu

Copeland, 1938:85; 1947:44; 1958:81

Only two species of this genus are known and the characters listed for the species described below are the characters of the genus.

1. A. cumingii Pr. **Plate 4**

Presl 1843, 112–113 pl. 7; Copeland, 1938:85; Tagawa, 1940:144; H. Ito, 1944: pl. 482; Iwatsuki, 1958:165; Ching, 1959:189–190, pl. 12 fig. 9–12.

Habrodictyon cumingii Pr.

v. d. Bosch, 1861:17 pl. 12.

Trichomanes cumingii (Pr.) C. Chr.

Rosenburgh, 1908:99; Copeland, 1933:257–258 pl. 56, fig. 1.2; Ogata, 1935, 6: pl. 295.

Epiphytes on trunks of tree ferns; rhizome short, erect; stipes caespitose; rhizome and stipe covered with stiff, dark brown, multicellular hairs; roots fibrous, about size of stipes, also bearing some multicellular brown hairs; fronds usually 3 to 12 cm long, narrowly ovate or lanceolate; rachis winged; ultimate segments linear, margins entire, slightly undulate; sori located along either side of the rachis, being borne near the base of the pinnules on their inner sides; indusia tubular, mouth flaring, undulate; receptacle exserted.

Cellular structure as seen in cleared slides; Cells more or less linear, at right angles to the axes (except for the one or two rows of cells along the margins, and those bordering the veins) Pl. 4. Fig. 10. Cells blocked off into rather long zones. (In this respect this species differs from *A. boninense* Tagawa et Iwatsuki which has the linear cells blocked off into many small rectangular zones.) Marginal cells much smaller and with thinner walls, parallel to margin; other cells have

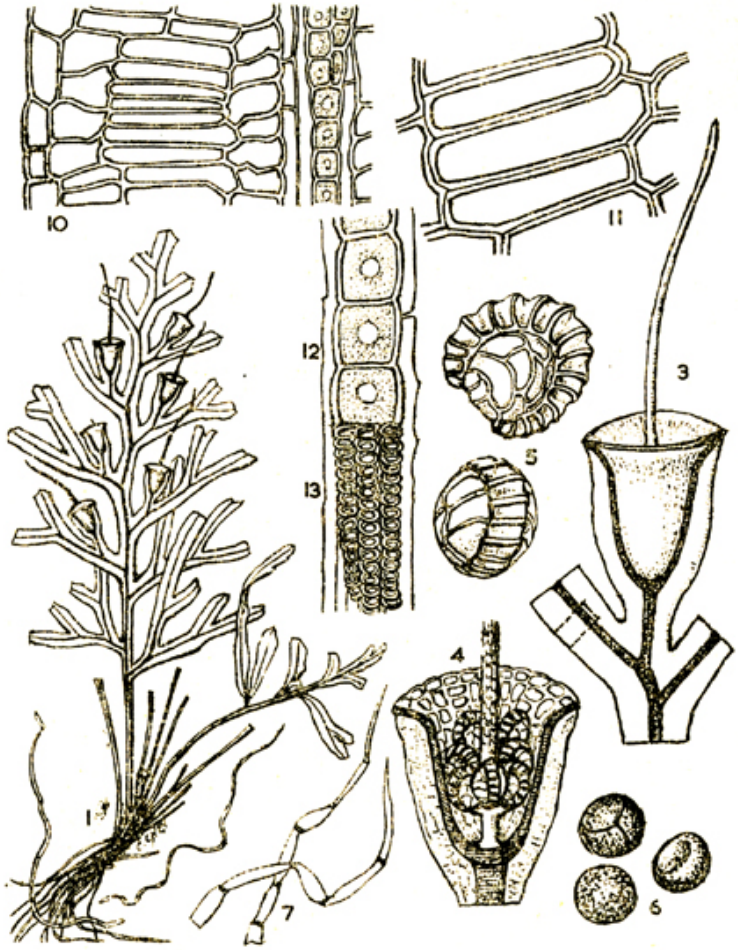

Plate 4. Abrodictyum cumingii Pr. Ching-shiu-shan, Hwalien Co., *T. Nakamura 3571.*

large lumen and walls that are uniformily smooth and thick; ours do not show the scalloped feature as illustrated by Copeland, 1933 pl. 56 fig. 2. (Pl. 13, Fig. 2)

We only have a few specimens of this species from the Philippines. They were collected in 1907 in San Ramon, Mindanao and distributed by E. B. Copeland. A cleared slide of this species has perfectly smooth walls and are exactly like our Taiwan plants. These Philippine plants do not have the scalloped walls like those illustrated by Copeland. Each vein has one or two rows of brachysclereids, lumen often almost obliterated, sometimes crescent-shaped; veins bordered by one or two rows of long, linear, thin-walled cells (Pl. 4. Fig. 12).

Distribution: Taiwan, Philippines, Celebes, Moluccas.

Taiwan:

Hualien County: Ching-shui-shan, *T. Nakamura 3571.*
Taitung Co., near Zyomura, *Tagawa 2806*; Tyokakurai, *Masuda* s. n.
Orchid Island, *Shieh* and *Chen* X, 13-30, 1967.

6. **Crepidomanes** Presl
假脈蕨屬 Chia Meh Chüeh Shu

Small ferns, seldom over 15 cm long, usually pinnatifid to tripinnatifid, but the "dwarf species" may only be digitately divided; usually growing on tree trunks, sometimes on mossy rocks; fronds with "false veins" which are specialized cells found either in a submarginal line or scattered striae; rhizome filiform covered with multicellular hairs, fronds distant; indusia tubular, receptacle usually exserted, most species with a bilabiate mouth; these ferns are quite variable, some of the "dwarf species" may only be small forms of larger species This group has been a most difficult one to deal with; just where to draw the line between the species is difficult to know.

1. Fronds usually 3 to 15 cm tall, bipinnatifid to tripinnatifid, ovate..... 2
1. Dwarf species, usually less than 2 cm tall 3
2. Submarginal vein interrupted, other false veins present, indusia mouth expanded, rounded.....1. *C. bilabiatum*
2. Submarginal vein absent, many short false veins present; indusia mouth elongated, acute.....2. *C. late-alatum*
3. Submarginal vein continous, with or without other false veins..... 4
3. Submarginal vein absent, but with many short false veins .....5. *C. palmifolium*
4. Fronds sessile or subsessile, 5 to 15 mm tall, rarely larger, pinnately or palmately divided .....3, *C. latemarginale*
4. Stipe nearly as long as blade; plants 5 to 8 mm tall, pinnatifid to bipinnatifid.....4. *C. nanophyllum*

1. C. bilabiatum (Nees et Bl.) Copel.

Copeland, 1938:59; Iwatsuki, 1958:161

T. bilabiatum Nees et Bl. Nov. Act. **11:** 123 (1823); Copeland, 1933:179 pl. 18: fig. 5, 6.

Rhizome creeping, covered with black multicellular hairs; roots few; fronds distant, ovate to narrowly ovate, tripinnatifid, 4 to 14 cm tall; submarginal vein interrupted, other false veins also present, variable in number; stipe winged to base or near base; sori borne on both sides of pinnae, indusia 2-lipped, mouth enlarged and rounded.

Cellular structure: Cells small, irregular but more or less polyhedral; walls straight, not much thickened; the interrupted submarginal veins and scattered false veins being made up of long rows of brachysclercids; the midrib and true veins also contain from one to several strands of these brachysclereids.

Distribution: Okinawa, Taiwan, Vietnam, Malaya, Java, Sumatra

Taiwan:

Taipei Co., Wulai, *T. Somai 98*; Rimogan, *Kudo 804.*
Ilan Co., Tsien-shan-hu, *T. Ito 97.*

Taitung Co., Hsinkang, *T. Suzuki 19667*; Tawu, *Shieh* and *Chen* IV-28-1968.
Orchid Island, *T. Hosokawa 8119*; Kotosyo, *T. Sata* VIII. 9. 1933.
Kaohsiung Co., Kweishan, *T. Suzuki 20870.*

2. **C. late-alatum** (v. d. B.) Copel.

Copeland, 1938:60; Masamune, 1954:5; H. Ito, 1949:125; Ohwi, 1957:28; 1965:36; Ching, 1959:165–166.

T. late-alatum (v. d. B.) Christ Verh. Nat. Ges. Basel **11:** 424 (1896).

Copeland, 1933:192 pl. 25, 26; DeVol 1945:47; Holttum, 1954:101.

Didymoylossum late-alatum v. d. Bosch. Ned. Kruidk. Arch. **5:** 138 (1863).

T. acutum Makino 1892:45; 1899:47.

T. insigne Beddome 1892:42.

T. bipunctatum var. *plicatum* Beddome 1892:42.

T. bipunctatum sensu Nakai, 1926:254; Ogata, 1928 (**1**) pl. 45, Matsumura and Hayata, 1906:564.

C. Makinoi (C. Chr.) Copel.

Copeland 1938:105; H. Ito, 1949:126; Ohwi 1957:29; 1965:36; Iwatsuki, 1958:71; Tagawa 1963:44 pl. 11 fig. 67.

T. Makino var. *tosae* (Matsumura) Lellinger 1968:158.

C. tagawanum K. Iwatsuki, 1958:161–162, fig. 1, 2.

T. filiculum Bory Voy. Bot. **1:** 97–136; Yabe, 1902:47; Hayata, 1914 (**4**): 137 fig. 74.

Rhizome widely creeping, covered with black multicellular hairs; roots few; fronds distant, narrowly ovate to lanceolate, 5–14 cm tall, bipinnatifid to tripinnatifid; without submarginal vein but with many short scattered short veins; stipe winged to base, 1–2.5 cm long, with black hairs at base; sori borne on both margins of pinnae; indusia 2-lipped, more or less elongate and acute at apex; receptacle exserted.

Cellular structure: Cells rectangular or irregular, walls straight, uniformly thick; with many scattered striae, the false veins being made up of rows of closely arranged brachysclereids. The main veins have several strands of sclereids; the smaller veins have one or two strands of sclereids.

Distribution: Northeast India, Malaya, Sumatra, Mainland China (Kwangtung, Kwangsi, Kweichow, Szechuan, Yunnan, Kiangsi), Taiwan, Japan.

Taiwan:

Taipei Co., Sendan-yama, *T. Suzuki 7485*; Buta et Rihoyen, *T. Suzuki 7548*; Ayu, *T. Suzuki 15313*; near Wulai (Ruggyahu) *T. Suzuki 18440, 16633*; Kabo-san, *T. Suzuki 13029.*
Hsinchu Co., Chia-tien-shan, *T. Suzuki 4579.*
Nantou Co., Chitou, *Kao 3011*; *Huang* 1504; Wushe, *Masamune 2324.*
Kaohsiung Co., Kweishan, *T. Suzuki 21042.*
Hualien Co., Kwai-lin to Pan-Shih, *Shieh* and *Chen* IX-9-1968.
Taitung Co., Ching-shui-yuan, *H. Fukugama 3803.*
Ilan Co., Nanao, *T. Suzuki 18610.*
Orchid Island; Kotosho, *Kawakami* and *Sasaki 18*; *Shieh* and *Chen* X-13-30, 1967.

3. C. latemarginale (Eaton) Copel. **Plate 5**

Copeland, 1938:60; Ching 1959:164–165.

Trichomanes latemarginale Eaton

Eaton, 1859:111; Dunn and Tutcher, 1912:336; Copeland, 1933:189, pl. 24; Tardieu-Blot, 1939:63; Holttum, 1954:101.

T. Kurzii Beddome 1868 pl. 286; 1892:40 fig. 20.

T. formosanum Yabe

Yabe 1902:46; 1905:31 fig. 1–4; Matsumura and Hayata, 1906:565. Type from Botel Tobago=Orchid Island. Merotype at TAIF.

T. nanum Hooker and Baker

Hooker and Baker, 1868:77; Matsumura and Hayata, 1906:566.

Very small ferns; rhizome filiform, creeping, covered with brown hairs; fronds distant, sessile or with very short stipes, 5 to 15 mm tall, digitately or pinnately

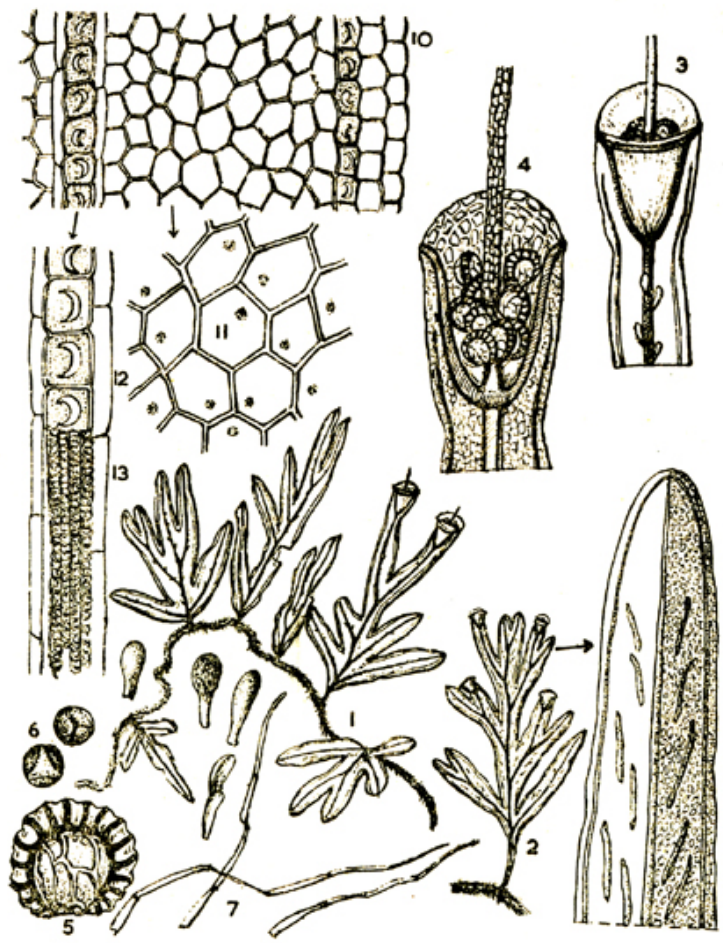

Plate 5. Crepidomanes latemarginale (Eaton) Copel. Hsinkang, Taitung Co., *T. Suzuki 19431.*

divided; ultimate segments linear, about 1 mm broad, obtuse or acute; submarginal vein continous or sometimes interrupted, other false veins usually absent; the undersurface bearing many brown, glandular clavate, one or two-celled hairs along the veins, sori terminal on lobes; indusia obconical, winged, mouth enlarged, often 2 lipped, lips rounded; receptacle exserted.

Cellular structure: Lamina cells small, irregularly polyhedral, walls thin, cytoplasm present, nuclei distinct; with a continuous or nearly continuous submarginal "vein" present, this being made up of a single row of brachysclereids arranged into a very long straight or somewhat crooked line; the median vein also has one or two parallel rows of similar sclereids; lumen of sclereids often crescent-shaped; veins with two rows of thin walled marginal cells. (Pl. 14 figs. 3, 4)

Note: *T. latemarginale* has striae in addition to the submarginal vein. (Pl. 5 fig 2) *T. Kurzii* and *T. formosanum* do not have striae in addition to the submarginal vein.

In *T. Kurzii* the submarginal vein is continuous. In *T. formosanum* the submarginal vein is interrupted.

Copeland has grouped these all together and says (1933:190) that he has seen intergrading forms between). We have not seen the intergrading forms on the same rhizome and do not know if they are all one.

Distribution: India, Malaya, Hongkong, Mainland China (Kwangtung), Taiwan, Bonin Islands.

Taiwan:

Taipei Co., Wulai, *T. Suzuki 20563.*
Taitung Co., near Hsinkang, *T. Suzuki 19431* (alt. 500 m)., *19585.*
Orchid Island *K. Miyabe*, XI. 28-1899.

4. C. nanophyllum Tagawa

Tagawa, 1940:142; 1951:186.

Trichomanes nanophyllum (Tagawa) Morton

Morton, 1968:183.

Dwarf ferns, 6–8 mm tall, pinnatifid to bipinnatifid, decurrent at base; rhizome black, creeping, filiform, covered with dark brown hairs; roots absent; stipe 1–2 mm long, wingless and black at base, covered with brown hairs; lamina with a continuous submarginal vein, other striae absent; ultimate segments less than 1 mm broad, obtuse at apex; sori sunken, indusia obconic, mouth expanded, receptacle exserted.

Cellular structure: Laminar cells irregular in shape; walls thin; submarginal vein composed of a single continuous row of brachysclereids; margin composed of a single row of oblong thin-walled cells; true veins contain one or two rows of brachyclereids.

Distribution: Taiwan, Okinawa.

Taiwan:

Taitung Co., near Aroe, Taito-gun, *Tagawa 2413.*
Pingtung Co., Mt. Nan-jen, *Kao 7313.*
Orchid Island, Shieh and Chen X-13-1967.

Habitat: Growing in mats on wet rocks in dense forests. Altitude 300–500 m.

5. C. palmifolium (Hayata) DeVol, comb. nov. **Plate 6**

Trichomanes palmifolium Hayata

Hayata, 1914(4):138 fig. 78.

Rhizome widely creeping, covered with multicellular dark brown hairs; stipes very short, about 5 mm apart; fronds nearly sessile; variable in shape, from ovate and broad at base, to deltoid and cuneate at base, deeply lobed, up to 15 mm tall; ultimate segments acute; without submarginal vein; veins forking and with short scattered striae between the true veins; short, glandular, brown hairs borne on the

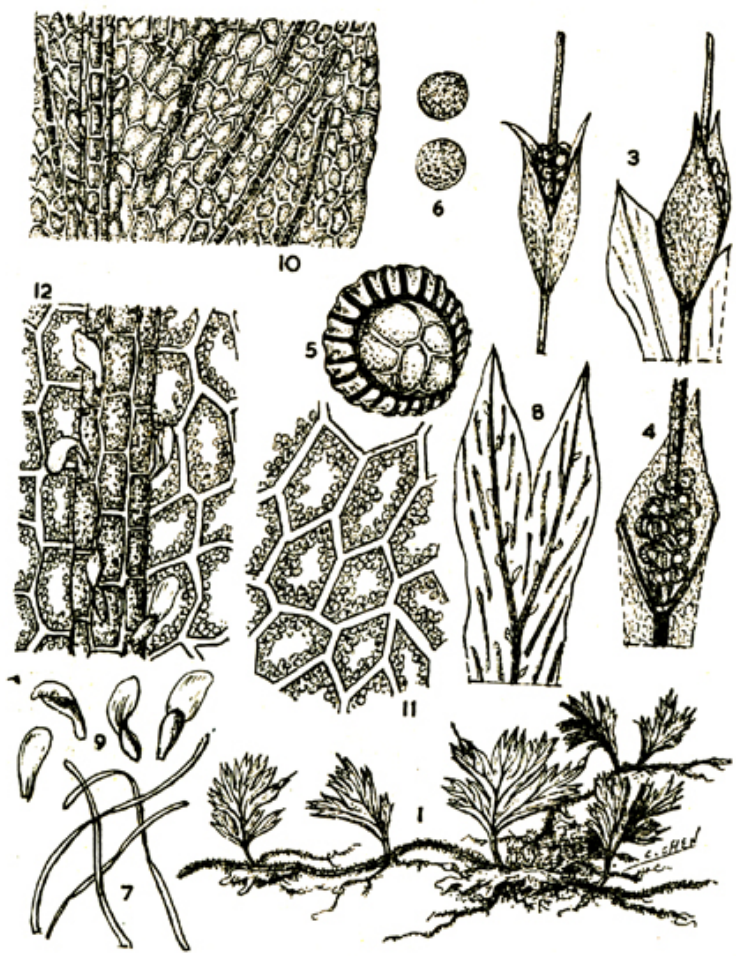

Plate 6. Crepidomanes palmifolium (Hayata) DeVol
Fen-chi-hu, Chiayi Co., *Shieh* and *Chen* VIII. 11. 1968.

underside along the veins; surface tends to fold under dry-conditions; indusia 2-lipped, triangular and acute at apex, receptacle long exserted.

Distribution: Taiwan

Taiwan:

Chiayi Co., Mt. Ali, *Hayata* and *Sasaki* I, 1912; Fen-chi-hu, *Shieh* and *Chen* VIII, 11, 1968.

7. Crepidophyllum

厚邊蕨屬 Hou Pien Chüeh Shu

Reed, 1948:88

Rhizome filiform, covered with hairs; fronds small bipinnatifid, distant, margins with one or two rows of specialized, elongated cells their radial walls being very oblique; sori solitary, i.e. with only one sorus borne on each pinna, these being borne on the lowest acropetal segment of each fertile pinna; indusia tubular, mouth expanded, receptacle exserted.

1. C. humile (Forst.) Reed 1948:88–89. **Plate 7**

Crepidopteris humilis (Forst.) Copel.

Copeland, 1938:58; Copeland, 1947:39; Ching, 1959:174.

Trichomanes humile Forster

Forster, 1786:12; Hooker and Greville, 1831: pl. 85; Copeland, 1933:164, pl. 12. fig. 1–2–3; Ogata, 1935, **6**: pl. 296; Holttum, 1954:98, fig. 34; Matsumura and Hayata, 1906:565; Hayata, 1914(4): 138 fig. 75.

Crepidomanes humile (Forst.) v. d. B.

van den Bosch, 1861:16, pl. 11.

Rhizome filiform, densely covered with short, dark brown hairs; fronds bipinnatifid, narrow, usually only 1.5 cm long, but occasionally up to 10 cm long, lower pinnae gradually shortened; margins with 2 rows of elongated cells; ultimate segments linear, obtuse, occasionally notched at apex; rachis winged; stipe narrowly winged above, not winged at base; veins bearing scattered glandular septate hairs.

Cellular structure: Cells small polyhedral, walls straight, slightly thickened; marginal cells elongated, in 2 rows, parallel to margin; veins with small spiral tracheids and a row or 2 of very thick walled brachysclereids, lumen round or crescent-shaped.

Distribution: Malaya, Indonesia, Philippines, Taiwan, Micronesia, Polynesia, New Zealand.

Taiwan:

Hwalien Co., Kwarenko, Tarokokyo, *S. Sasaki* VI. 3. 1933.
Taitung Co., Hsinkang, *T. Suzuki 19438*; Taitung, *C. K. Wang*, IV. 1961.
Orchid Island, *S. Sasaki* VII. 12. 1912; *Masamune 4156*; *N. Fukuyama* XI. 1934; *Shieh* and *Chen* X-13-1967.
Green Island, T. Soma 112.

Plate 7. Crepidophyllum humile (Forst.) Reed

8. **Microgonium** Presl

單葉假脈蕨屬 Tan Yeh Chia Meh Chüeh Shu

Presl, 1843:111; van den Bosch 1861:5; Copeland, 1938:61; 1947:39; 1958:73.

Very small epiphytes; rhizome filiform, covered with brown hairs, roots absent; fronds simple, orbicular or ovate or obovate, rarely lobed; false veins present; indusia tubular, mouth expanded, receptacle usually exserted.

1. Fronds peltately attached; undersurface bearing hairs along veins.....3. *M. omphalodes*
1. Fronds attached at base, hairy at base..... 2
2. Fronds petiolate, with a continuous submarginal vein.....2. *M. bimarginatum*
2. Fronds sessile, winged to base; without a submarginal vein...1. *M. beccarianum*

1. M. beccarianum (Cesati) Copel. **Plate 8**

Copeland, 1938:63; 1958:74; Tagawa 1941:143; Hosokawa, 1941:41; Masamune,

1954:5; Nishida 1957:155 fig. 1. Ching, 1959:159.

Trichomanes beccarianum Cesati

v. A. v. Rosenburg, 1908:86; Copeland, 1933:200 pl. 29.

T. motleyi v. d. Bosch, Ned. Kruid. Arch. (5)1861:145.

sensu Yabe, 1902:46; 1905:31; Matsumura et Hayata, 1906:566; Nakai, 1926:253; Holttum, 1954:92 fig. 30.

Microgonium motleyi v. d. B.

van den Bosch, 1861:5, pl. 1.

Rhizome creeping, covered with dark brown hairs; fronds very close, often overlapping, 3 to 5 mm long; sterile fronds variable in shape, orbicular to obovate, sessile, main vein short with many fine radiating veins, rounded or cuneate at base; fertile fronds obovate, cuneate at base, notched at apex, bearing a single sorus, indusia free, tubular, mouth expanded.

Cellular structure: Laminar cells oblong, with straight, very thin walls, and usually with square ends, arranged in parallel rows, and with a single row of nearly square cells along the apical margin; the true veins and false veins being made of thick walled oblong brachysclereids arranged in single rows, their lumen being about as wide as their walls, and the inner lining of their lumen usually being quite jagged; false veins usually pointed or slightly forked at their ends; long, yellow, non-septate hairs borne at base of frond.

Distribution: Taiwan, Okinawa, Micronesia, Ceylon.

Taiwan:

Kaohsiung Co., Teraso-yama, *T. Suzuki 6159.*

Taitung Co., Chang-yuan, *T. Suzuki* (Growing with *19431*);(1) Tawu, *Shieh* and *Chen* IV, 23, 1968.

Orchid Island, Kotosho, *K. Miyake* XI. 21, 1899; *Shieh* and *Chen 404, 407.*

2. M. bimarginatum v. d. Bosch

van den Bosch, 1861:7; Copeland, 1938:61; Nishida, 1956:106–107; 1957:155; Ching, 1959:160; Masamune, 1954:5;

T. bimarginutum v. d. B.

v. A. v. Rosenburg, 1908:86; Nakai, 1926:252; Copeland, 1933:208 pl. 33 fig. 1–4; Holttum 1954:92.

T. neilgherrense Bedd.

Beddome 1863, pl. 6; 1892:37; Hooker and Baker, 1868:74; Matsumura and Hayata, 1906:566 Yabe, 1905:31.

Rhizome filiform, creeping, covered with long yellow-brown hairs; roots absent; fronds about 1–2 cm long; simple, of various shapes ranging from ovate to obovate; margins entire, undulate, or somewhat lobed; stipe 2–5 mm long, also bearing long yellow-brown hairs; marginal vein nearly continuous, midrib distinct, giving off

(1) (This species was collected growing with *Crepidomanes latemarginale 19431* but was not mentioned by T. Suzuki on his label)

lateral veins; false veins present; sori terminal, sunken in frond, indusium tubular, mouth expanded. (Description based on specimens from Micronesia, Palau. *Hosokawa 9667*)

Cellular structure: Lamina cells oblong with thin, straight walls; true veins and false veins spaced about equal distant apart, composed of oblong, thick walled cells, lumen about as wide as the cell walls; false veins being only one cell wide, the true veins being 2 or more cells wide; marginal cells of thin walls and square ends; stipe and lower part of midrib bearing long non-septate hairs.

Distribution: Ceylon, Malaya, Thailand, Taiwan, Micronesia, Polynesia, Queensland.

Taiwan:

Taipei Co., Wulai: Rahau, collected by *K. Miyake* X. 22. 1899, no recent collections of this fern have been reported.

3. **M. omphalodes** Vieillard ap. Fournier in Ann. Sci. Nat. V. 18:255 (1873) Copeland, 1938:63; Masamune, 1954:5; Hosokawa, 1941:41; H. Ito, 1944 pl. 477; Nishida, 1957:154. **Plate 8**

T. omphalodes (Vieillard) C. Chr.

Copeland, 1933:203, pl. 31, fig. 1 to 6; Ogata, 1933, 5 pl. 248; H. Ito, 1938:584, Ching, 1959:158.

T. peltatum Baker 1866:336 pl. 8, c. (Type from Samoa.)

Fronds 10–15 mm in diameter or larger, more or less orbicular, sessile, peltately attached near center, or somewhat off center; surface flat or with center depressed and surface wavy: margins entire, wavy, or notched; main veins reaching from center to margin; "false veins" between the true veins, shorter, not starting from the center: under surface of frond bearing many dark brown hairs along the veins and false veins; rhizome creeping, covered with short dark brown hairs; indusia somewhat immersed or free, tubular, mouth much expanded.

Cellular structure: Cells oblong, with square ends, in parallel rows, walls thin; the false veins being composed of long rows of brachysclereids, these being only one cell wide, their lumen being very small, and almost flattened, the cross walls between these cells being scarcely visible; veins and false veins bearing many, thin-walled, long, brown, non-septate hairs along their sides; the larger true veins contain at least one strand of spiral tracheids.

Distribution: Taiwan, Okinawa, Indonesia, Polynesia, Micronesia.

Taiwan:

Taipei Co., Wulai, *DeVol* and *Kao, 9013*; *J. M. Chao*, Dec. 14, 1964; Chu-Shan-Yuan, *T. Ito 24*; *T. Suzuki 5530, H. Shimada* I-21-1933.

Taitung Co., Kusuhara, *T. Suzuki 19437*; Tawu, *Shieh* and *Chen* IV-23-1968.

Ilan Co., Mt. Oobi, *G. Masaumune* IV-27-1938.

Kaohsiung Co., Mt. Teraso-yama, *T. Suzuki 6158*.

Habitat: Growing on trunks of trees in forests or on moss covered rocks.

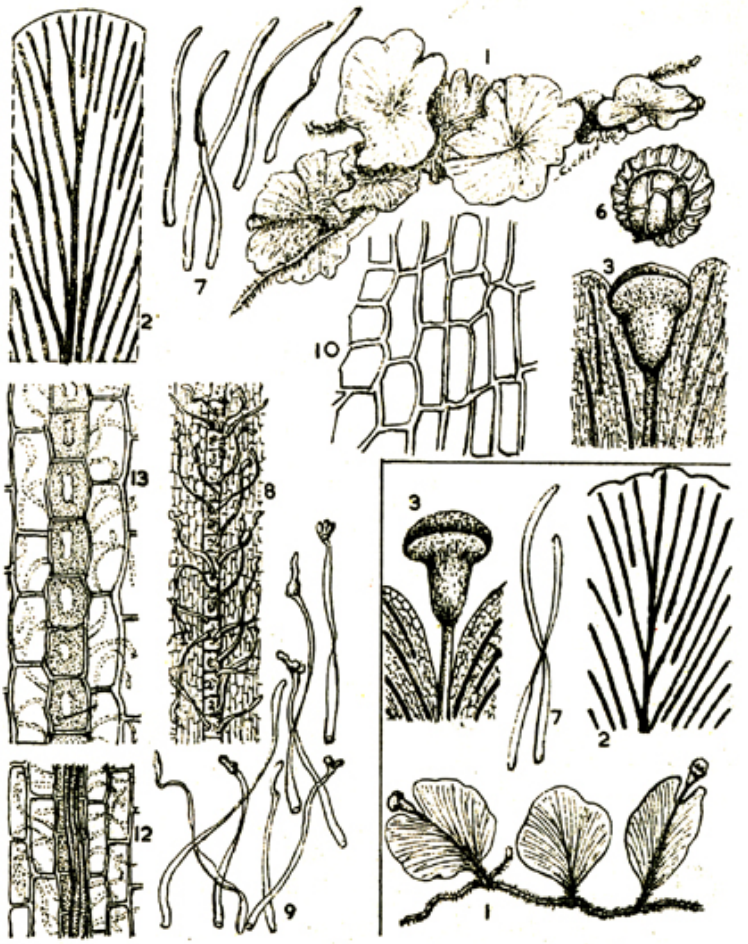

Plate 8. left: **Microgonium omphalodes** Vieillard Wulai, Taipei Co., *DeVol 9013.* Lower right: **Microgonium beccarianum** (Cesati) Copel. Kotosho, Orchid Island, *Shieh* and *Chen 404.*

9. **Gonocormus** v. d. Bosch

團扇蕨屬 T'uan Shan Chüeh Shu

van den Bosch, 1861:7; Copeland, 1938:56; 1947:38; 1958:68.

Small ferns growing on mossy rocks or tree trunks; rhizome filiform, long creeping; fronds irregularly dichotomously lobed, often fan-shaped, or pinnately divided; in some species the primary frond may produce a second frond; the production of proliferous fronds is considered the outstanding character of the genus; sori often sunken in tips of segments, indusia tubular, mouth much dilated, receptacle exserted.

1. **Gonocormus minutus** (Bl.) v. d. Bosch **Plate 9**

van den Bosch 1861:7, pl. 3; Copeland, 1938:57; 1958(1):68; H. Ito, 1949:125;

Masamune, 1954:5; Ohwi, 1957:28; 1965:35; Ching, 1959:175; Tagawa, 1963:44, 216, pl. 11: fig. 68.

Trichomanes minutum Bl.

Blume 1828:223; Holttum, 1954:96; Rosenburgh, 1908:90.

T. parvulum Poir. sensu Beddome, 1892:39, fig. 18; Matsumura and Hayata, 1906:567; Nakai 1926:262; Ogata, 1931(4); pl. 199; Komarov and Klobukova, 1931:46 fig; 1934:18. pl. 1. fig. 2.

T. saxifragoides Presl, 1843:131; Christ, 1898:141.

T. orbiculatum Ching ex Ogata, 1939:694; DeVol, 1945:47.

Rhizome slender, without roots but covered with brown hairs; stipes 0.5–1.5 cm long, not winged; primary frond fan-shaped, dichotomously branched, not dissected to base, usually not over 1 cm long, sometimes wider than long, sometimes proliferous, but specimens from Siberia, Japan, Mainland China and Taiwan are usually

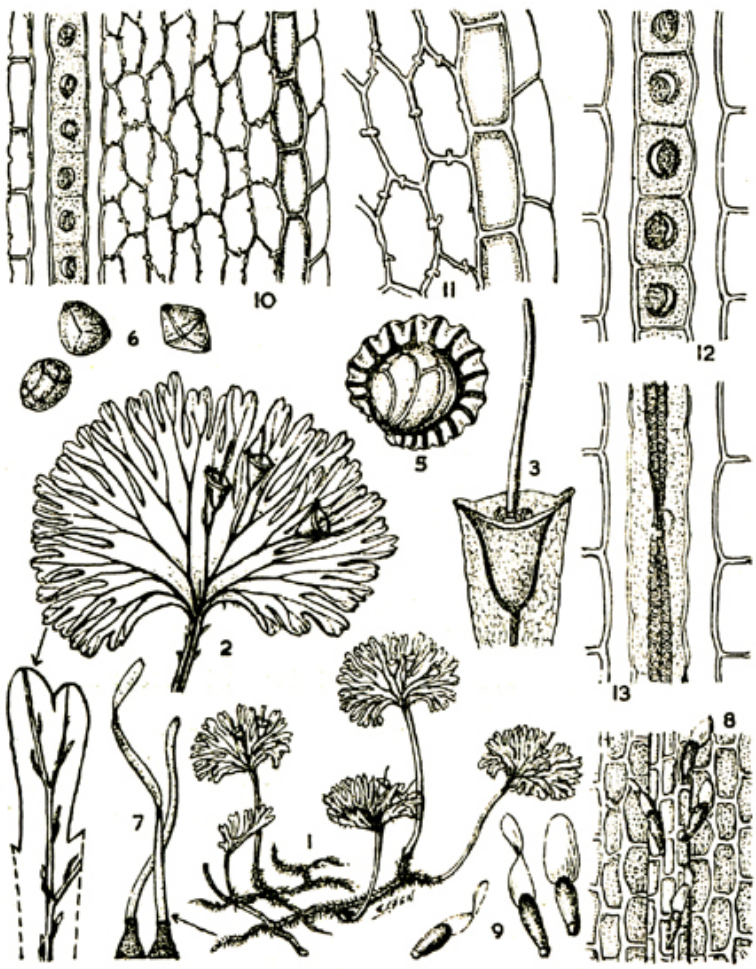

Plate 9. Gonocormus minutus (Bl.) v. d. B.
Lintien Shan, Hwalien Co., *Chao* and *Feung 60.*

not proliferous; veins dichotomously branching and without false veins between the true veins; sori sunken in apices of segments, or terminal on lobes and free; indusia tubular, winged, mouth much dilated, receptacle exserted.

Cellular structure: Cells rectangular, oblong or somewhat irregular in shape, arranged in parallel rows and with one or two rows of submarginal cells having considerably thicker walls than the other cells of the lamina; the cell walls of laminar cells are somewhat uneven, being slightly warty; each vein having one or two narrow spiral tracheids and one or more rows of much wider brachsclereids, their cross walls often being barely visible, and their lumen being very small and crescent-shaped; with minute, glandular, septate hairs borne along the underside of veins.

Distribution: Siberia, Mainland China, Taiwan, Japan, Philippines, Indonesia, Malaya, Polynesia, Africa.

Taiwan:

Taipei Co., Kueishan, *C. Chuang 3103*; Chi-Shan-Yen, *Soma 205*; Kwang-yin, *Feung 123*; *T. Nakamura* VI. 23, 1940; Wulai, *C. Chuang 2130*; *Faurie* April 1914; Nan-shih-chiao, *Masamune 2802*; Yuan-shan, *Y. Shimada 136*; Ta Tun Shan, *DeVol 9031.*
Ilan Co., Nahau, *Kao 30104*; Kueishan Island, *G. Masamune* 7. 3. 1932.
Hwalien Co., Mt. Lintien *Feung 60.*
Taitung Co., Hsin Kang, *T. Suzuki 19460*; Tawu, *Shieh* and *Chen* IV-23-1968.
Pingtung Co.; Raisya, *Matude 1092*; Teraso, *T. Suzuki 6159.*
Orchid Island, *S. Sasaki* VI. 3, 1926; *Shieh 432.*
Nantou Co., Mei-yuan, *S. C. Cnang* I-11-1968; Lushan, *Shieh* VII-10, 1967; Lien-hwa-chih, *T. F. Chen 1359.*

Habitat: On trees and mossy rocks, often growing with leafy liverworts and aerial algae.

10. **Microtrichomanes** (Mett.) Copeland
細口圍扇蕨屬 Hsi Keo Tuan Shan Chüeh Shu
Copeland 1938:35; 1947:37.

Very small ferns usually growing on tree trunks or mossy rocks; rhizomes filiform, fronds distant; stipes long, filiform; fronds dichotomously lobed; lobes narrowly linear and usually of about equal length, but in one species the frond is elongate and bipinnatifid, margins entire but in some species bearing simple or branched hairs or bristles; herbarium specimens have very dark brown fronds; sori terminal on the linear lobes, indusia sunken in apex of fronds, short, about as wide as long, conical; lip enlarged, with or without cilia or bristles, undulate, pressed specimens sometimes appear to be 2–lobed; receptacle exserted; cell walls thin.

1. **M. nitidulum** (v. d. B.) Copeland **Plate 10**
Copeland, 1938:37, Masamune 1954:4

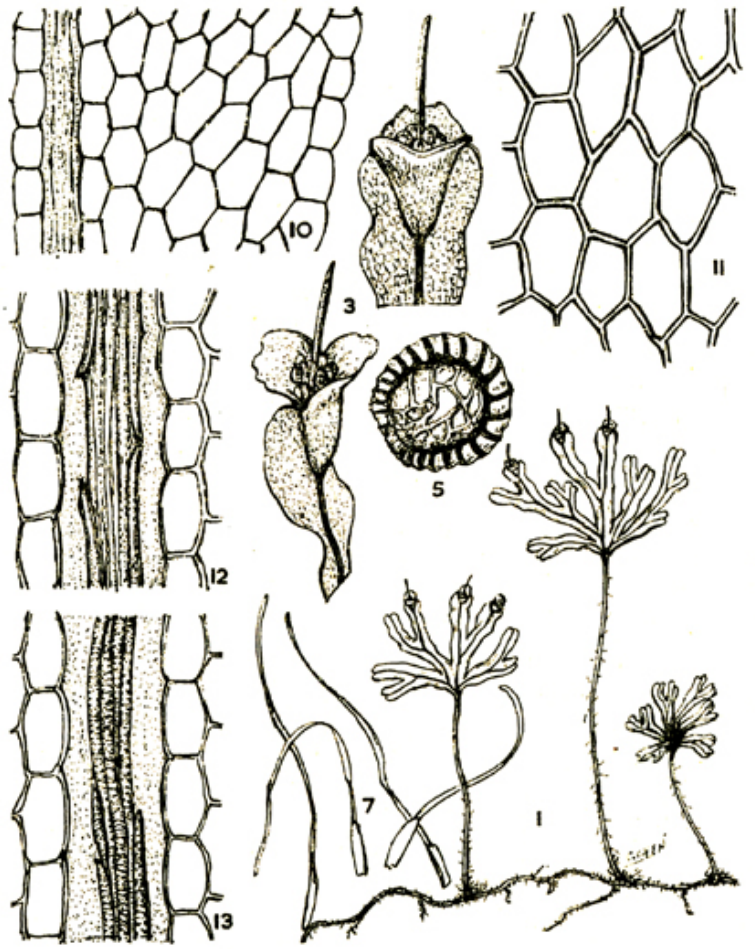

Plate 10. Microtrichomanes nitidulum (v. d. B.) Copel.
Luan-shan, Hwalien Co., *Kao 6973.*

Trichomanes nitidulum v. d. B.

van den Bosch, 1856:547; 1861:21 pl. 15; Rosenburgh, 1908:88; Copeland 1933:155 pl. 7 fig. 1.

Rhizome and stipe bearing long, scattered, weak hairs; fronds dichotomously lobed, dissected to base, 1–2 cm long; stipes filiform about twice as long as blade; margins of lobes without hairs or bristles; lobes 1 to 2 mm broad; herbarium specimens dark brown; without false veins; sori terminal on lobes, sunken, indusia conical; lip enlarged, deeply undulate, without marginal hairs; receptacle somewhat exserted.

Cellular structure: Laminar cells polyhedral, irregular in size and shape, walls very thin and straight; veins with a central strand of small spiral tracheids, but without the accompanying brachysclereids or pitted sclerenchyma cells

commonly seen in many of the *Trichomanes*, in their place are long thick-walled cells with narrow lumen. (Plate 10, fig. 12)

Distribution: Ceylon, Java, Sumatra, Borneo, Vietnam (Tonkin), Taiwan, New South Wales.

Taiwan:

Taipei Co., Kentôbozan *Suyuki-Tokio 19341* (near border of Ilan and Taipei Co.) Habun, *Suzuki-Tokio 17354*; Remogan, *Suzuki-Tokio 17018*.
Hwalien Co., Luan-shan, *Kao 6973*. On bark of dead tree.

Habitat: On trunks of trees, or on mossy rocks.

Note: The veins stain very heavily and the individual cells are not clear on our slides; but thus far no brachysclereids or pitted sclerenchyma cells have been seen, and in their place appear long thicked walled cells with narrow lumen.

11: Pleuromancs Presl

毛葉蕨屬 Mao Yeh Chüeh Shu

Presl 1849:258; Copeland, 1938:55–56; 1947:38; 1958:66–67.

Epiphytes; rhizome filiform, widely creeping bearing long scattered hairs; rooting at intervals; fronds bipinnatifid to tripinnatifid; submarginal cells with thick walls; midrib wide, and thickened; lamina bearing scattered hairs.

1. P. pallidum (Bl.) Presl **Plate 11**

Presl, 1849:258; Copeland 1938:56; 1958:67; H. Ito, 1944 pl. 472; Masamune, 1954:5; Ching, 1959:172–173.

Trichomanes pallidum Bl.

Blume 1828:225; Beddome, 1892:41; Matsumura and Hayata, 1906:566; Rosenburgh, 1908:93; Copeland, 1933:141; Ogata, 1935 (6): pl. 299; Holttum, 1954:97

Craspedomeuron pallidum v. d. B.

van den Bosch 1861:14 pl. 8; also see pl. 7, pl. 9.

Rhizome filiform, widely creeping, bearing long, yellow, scattered hairs; rooting at intervals; fronds distant, bipinnatifid to tripinnatifid, ovate; lamina 3–15 cm long, 12–30 mm broad, rachis winged, stipe about as long as blade, wingless; blade bearing scattered hairs similar to those on stipe and rhizome, costa wide and thickened; bearing scattered hairs; sori borne on acroscopic branches of pinnae; indusia tubular, winged, mouth truncate or somewhat dilated, sometimes 2-lipped; receptacle exserted.

Cellular structure: Lamina cells long, with straight, thin pitted walls; submarginal cells long, with thick walls, deeply stained with safranin, but these are not brachysclereids, and are not considered false veins; marginal cells long, very narrow and with thin walls; costa wide, with 1 or 2 small spiral tracheids through center, without any brachysclereids, mostly made up of long parenchyma cells with wide lumen and having simple pits on their sides and ends. (Pl. 14 fig 1, 2)

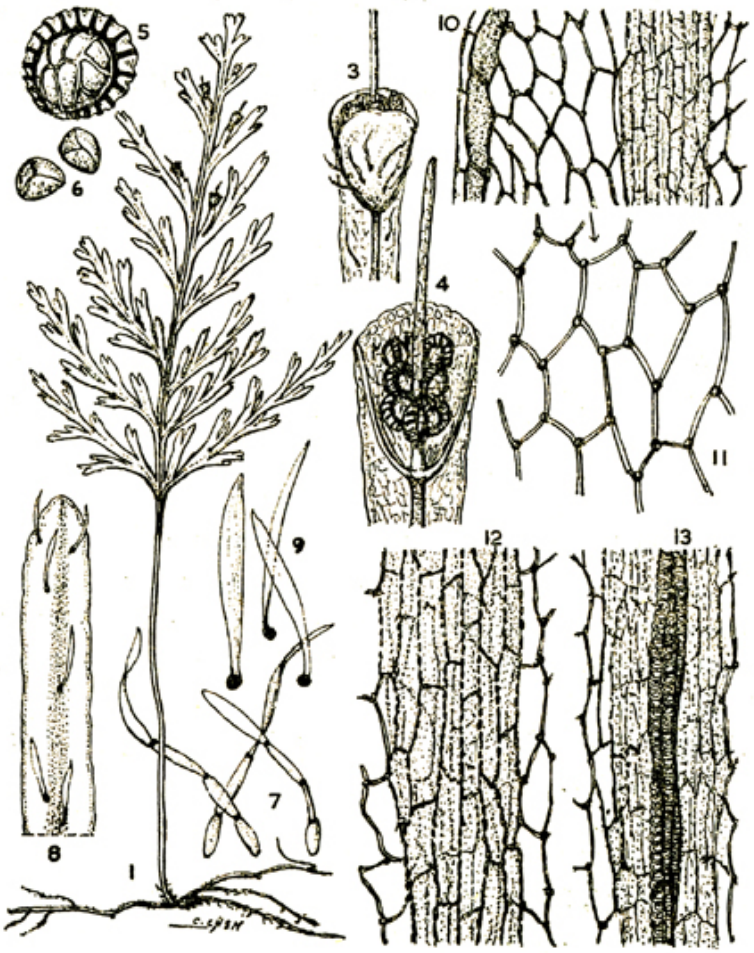

Plate 11. Pleuromanes pallidum (Bl.) Pr. Lachialachia, Taitung Co., *Kao 6871.*

Distribution: Ceylon, India, Indonesia, Malaya, Thailand, Vietnam, Philippines, Polynesia, Hainan, Taiwan.

Taiwan:

Taipei Co., Kuaishan, *T. Suzuki 18189.*
Taitung Co., Lachialachia Shan, *Kao 6871.*

Habitat: Growing in tops of high trees.

12. **Vandenboschia,** Copeland

瓶蕨屬 P'ing Chüeh Shu

Copeland, 1938:51; 1958:64

This section of *Trichomanes* is characterized by having creeping rhizomes and distant fronds; rhizomes in some species being filiform and about 0.3 mm in diameter, in other species much stouter and up to 2 or 3 mm in diameter; rhizomes often

covered with multicellular dark hairs; stipes not winged or winged to base, never tufted; fronds pinnate to decompound; indusia tubular, often winged, receptacle exserted; **Cellular structure of leaves:** Without striae or submarginal veins; cell walls thin, straight, marginal cells may differ in shape from others by being longer and parallel to margin, walls may be thinner. These ferns grow as epiphytes or on moss covered rocks.

Key to species

1. Rhizome filiform, about 0.3 mm in diameter, fronds bipinnatifid..... 2
1. Rhizome not filiform, 1–2 mm in diameter, tube of indusia not sunken..... 4
2. Fronds less than 3 cm long.....(7. *V. parvum*)[1]
2. Fronds usually more than 5 cm long, tube of indusia sunken in frond 3
3. Fronds about 6 to 10 cm long, bearing minute, clavate glandular hairs along costa and main veins.....6. *V. pyxidiferum*
3. Fronds 10 to 25 cm long, without glandular hairs along costa.....5. *V. latifrons*
4. Sterile fronds pinnate, sessile or nearly so; margins of pinnae irregularly crenulate .....1. *V. auriculatum*
4. Sterile fronds 3 to 4 pinnatifid with long stipes..... 5
5. Fronds 4–pinnatifid, ultimate segments linear 1 mm broad, dissected to base.....2. *V. maximum*
5. Fronds 3–pinnatifid; pinnules not cut to base 6
6. Fronds (including stipe) 25 to 60 cm long; stipe and rachis covered with long multicellular hairs, especially plentiful at base of pinnae; rachis wing very narrow .....4. *V. naseana*
6. Fronds (including stipe) 4 to 15 cm long; stipe and rachis without long multicellar hairs; rachis wing wide .....3. *V. orientalis*

1. V. auriculata (Bl.) Copel.

Copeland, 1938:55; 1958:66; H. Ito, 1944 p. 471; 1949:125; Ohwi, 1957:27; 1965: 35; Ching, 1959:181; Tagawa, 1963:40:

Trichomanes auriculatum Bl.

Blume, 1828:225; Beddome, 1892:44; Matsumura and Hayata, 1906:564; Nakai, 1926:262; Ogata, 1931(**4**): pl. 198; Copeland, 1933:223; H. Ito, 1938:52; DeVol, 1945: 47; Holttum, 1954:105.

Cephalomanes auriculatum v. d. Bosch 1861:34 pl. 25.

Rhizome very long, creeping on rocks, or scandent on trees, covered with multicellular dark-brown hairs on lower side; roots absent; fronds distant, sessile or nearly so, stipes up to 4 mm long; lamina 10 to 40 cm long, and usually 2 to 3 cm

(1) Iwatsuki (1958: 70) considers this a stunted form of *V. orientalis* and he is probably correct. I am leaving it in the key so that those who try to identify this small fern will be able to do so.

wide; sterile fronds pinnate, margins lobed and crenate; fertile fronds with pinnae deeply laciniate; midrib present, veins dichotomously forking; rachis winged and bearing scattered linear, brown, multicellular hairs on underside; sori marginal, free (not sunken except at base), plentiful; indusia tubular, slightly winged, mouth truncate, not expanded or only slightly so; receptacle exserted.

Cellular structure: Laminar cells small, polyhedral, irregular in size and shape; walls thin and straight; without specialized marginal cells or false veins; veins with spiral tracheids in center, bordered by one or 2 rows of small almost square or oblong brachysclereids with round or crescent-shaped lumen; margins of veins composed of long selerenchyma cells with a few scattered, simple pits.

Distribution: Japan, Okinawa, Taiwan, South China (Yunnan, Hainan), Philippines, Indonesia, Malaya, Thailand.

Taiwan:

Taipei Co., Habun, *T. Nakamura 517*; Shan Chia, *S. Suzuki 5892*; Ayu, *M. T. Kao 30064*; Kan kou, *S. Sasaki* Nov. 2, 1932; Hsintion, *T. Suzuki 13787*; Wulai, *S. Suzuki* Nov. 9, 1938; Between Tsi-Hsin Shan and Ta-Tun Shan *DeVol 9030.*

Hsinchu Co., Lu-chan-ta-Shan, *N. Fukuyama 3400*; Soten, *T. Suzuki 4584*; Wu-Tsi Shan, *Kawakami 88.*

Taichung Co., Pa-Hsien-Shan, *S. Suzuki* Oct. 2, 1929; Ta-Chien *S. Sasaki* Aug. 20, 1929; Mei-yuan, *S. Sasaki 91.*

Nantou Co., Chin Shui Kou, *T. C. Huang 944*; Chi-tou, *T. C. Huang 1442*; Lien hua-chih, *S. S. Feung 369*; Wu She, *G. Masamune 2166*; Sun Moon Lake, *DeVol 1241*; Ho-she, *C. C. Kuo 830*; Ren-lun, *Shieh* et *Chen*, IX-12, 1967.

Chiayi Co., Mt. Ali, *B. Hayata, 86.*

Kaohsiung Co., Ma-ni-pa, *S. Sasaki* III-24-1932.

Pingtung Co., Raisya, *E. Matuda* July 1-1916; Wu-wei-shan, *S. Sasaki 93.*

Taitung Co., Shin-shui-yin, *H. Shimizu 3868*; Chien-chen, *T. Hosakawa 5225*; Taitung Mts, *Y. Yamamota 9*; Tawa, *S. Suzuki 6995*; Tiponzae, *S. Suzuki 10993.*

Orchid Island: Hung-Teo-Shan, *T. Hosakawa 9869.*

Ilan Co., Chilanshan, *J. M. Chao* June 1, 1966; Mt. Oobi, *G. Masamune*, April 23, 1938; Taiping Shan, *S. Suzuki 1117*; Ta-jen-Shan, *C. C. Kou 3173*; Mt. Bonbon, *M. T. Kao 5920.*

Hwalien Co., Taroko, *S. Suzuki 9702*; Mt. Lintien, *J. M. Chao 4*; Mu-Kua-Shan, *T. Nakamura 4375*; Lun-kao-yeh, *Shieh* and *Chen 971*; Kuailin to Pan-shih, *Shieh* and *Chen 557.*

2. V. maxima (Bl.) Copel.

Copeland, 1938:54; 1958:65; H. Ito, 1944 pl. 470; Nishida, 1956:107; Ching, 1959: 182.

T. maximum Bl.

Blume, 1828:228; v. d. Bosch, 1861:25 pl. 18; Hayata, 1914(4):138; Nakai, 1926: 267; Copeland, 1933:217 pl. 38 fig. 1–4; Ogata, 1935(6) pl. 298; Holttum, 1954:107.

T. Miyakei Yabe

Yabe 1905:34; Matsumura and Hayata, 1906:566 (Type from Rahao, Formosa).

V. liukiuensis (Yabe) Tagawa

Tagawa, 1951:185; 1963:43 fig. 72.

T. liukiuensis Yabe

Yabe, 1905:35; Nakai, 1926:268; H. Ito 1938:583.

Rhizome creeping, 2 mm in diameter; roots and rhizome covered with dark brown multicellular hairs; fronds 1 to 2 cm apart, stipes terete, 6 to 15 cm long, winged almost to base, bearing brown multicellular hairs at base similar to those borne on the rhizome; fronds up to 40 cm tall, 4–pinnatifid; ultimate segments very narrow, linear, with only one vein in each segment; sori terminal on lobes; indusia tubular, mouth somewhat expanded, sometimes slightly 2–lipped; receptacle long exserted.

Cellular structure: Cells small, irregular in shape, walls wavy, very thin; marginal cells not different from others; without false veins; small veins with one or 2 strands of spiral tracheids and one or 2 rows of brachysclereids, their lumen round and their inner margin quite irregular; the sclerenchyma cells bordering the veins being very long and with simple pits.

Distribution: Ryukyu, Taiwan, Philippines, Indonesia, Malaya, Thailand, Vietnam.

Taiwan:

Taipei Co., Yang-ming-shan, *T. Shimuda 37*; Kankou, *S. Sasaki* Nov. 6, 1932; *DeVol 9061.*
Miaoli Co., Kwantozan, *T. Suzuki 20089.*
Pingtung Co., *Y. Shimada 124.*
Orchid Island, Botel Tobago, *S. Sasaki* July 1912.
Taitung Co., Su-ka, *Simozawa* I. 3. 1938.

3. V. orientalis (C. Chr.) Ching **Plate 12**

Ching, 1959:187

Trichomanes orientalis C. Chr.

Christensen, 1906:646; Dunn and Tutcher, 1912:336; Hayata, 1914(4):138 fig. 77; Nakai, 1926:268; Ogata, 1928(1): pl. 47; Makino, 1940: fig. 963; DeVol, 1945:48.

T. japonicum Fr. et Sav.

Franchet et Savatier, 1879:207, 618. Matsumura and Hayata, 1906:565.

T. kalamocarpum Hayata

Hayata, 1915(5):260 fig. 93; Type from Mt. Ali collected by B. Hayata and S. Sasaki Jan. 1912, Isotype at TAIF.

T. radicans Swz., Schrad. Journ. Bot. 1800:97. Copeland, 1933:213 pl. 35 fig. 1, 2. Matsumura and Hayata, 1906:567; Holttum, 1954:107.

T. radicans var. *orientalis* (C. Chr.) Lellinger

Lellinger, 1968:157

V. radicans (Sw.) Copel

Copeland, 1938:54, H. Ito, 1944 pl. 469.

V. radicans var. *orientalis* (C. Chr.) H. Ito

H. Ito, 1949:125, Ohwi, 1957:27; 1965:35.

V. subclathrata Iwatsuki, 1958:70.

T. subclathrum (Iwatsuki) Morton, 1968:182.

Rhizome widely creeping, densely covered with dark brown multicellular hairs; roots present; stipes distant, 3 to 8 cm long, winged nearly to base, wing plane,

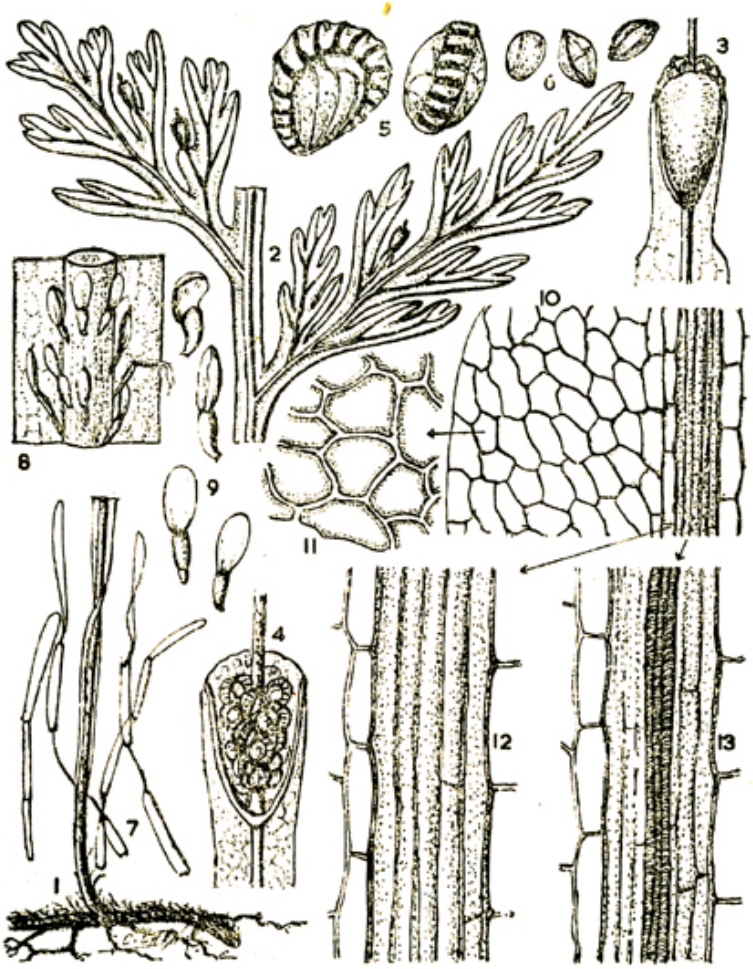

Plate 12. Vandenboschia orientalis (C. Chr.) Ching. Ta Tun Shan, Taipei Co., *DeVol 9032.*

lower part of stipe wingless; fronds ovate, about as long or longer than stipes, tripinnatifid, rachis winged; underside of rachis bearing many minute, septate, clavate, glandular hairs; but without the long multicellular hairs which are plentiful on *V. naseana*; sori free, stalked, winged; indusia tubular, mouth truncate, receptacle expanded.

Cellular structure: Laminar cells somewhat irregular in shape, but more or less oblong and in parallel rows, walls thin; without false veins or specialized marginal cells; veins with 1 to 3 central strands of spiral tracheids, surrounded by long sclerenchyma cells having simple pits, and a single row of brachsclereids; veins bordered by long thin walled cells.

Distribution: Japan, Korea, Okinawa, Taiwan, Mainland China (Anhwei, Chekiang, Fukien, Hunan, Kiangsi, Kwangsi, Kweichow and Yunnan).

Taiwan:

Taipei Co., Keelung, *Fauric* 22197; Chih-shan-yen, *S. Sasaki 96*; Reimogan, *T. Suzuki 18461*; Ta Tun Shan, *DeVol 9032.*

Miaoli Co., Kuang-tao-shan, *T. Suzuki 20091*; S. C. Chang, I-14-1968.

Taichung Co., Pa-hsien-shan, *S. Sasaki 132*; Lishan, *Feung 290.* Ta Hsuch Shan, *T. F. Chen 1392.*

Nantou Co., Ching-shui-kou, *Huang 923*; Lien-hua-chih, *Seki 98*; Lushan, Shieh 7. 10-11, 1967; Chitou, *C. S. Kuo* XII-6-1967; Luan-ta-shan, *Kawakami 39*; Hoshe, *C. C. Kuo 834*; Wan-Hsien, *Shieh* and *Chen*, IX-26-1968.

Chiayi Co., Mt. Ali, *Kudo* and *Suzuki 16251*; *Feung 167*; Er-wan-ping, *Hayata 133.*

Taitung Co., Tawu, *Matuda 81*; *Shieh* and *Chen* IV-23-1968.

Ilan Co., Si-mao-shan, *T. Nakamura 4672*; Ta-ping shan, *C. C. Chuang 4121.*

Hwalien Co., Yu-li, *T. Suzuki 19447*; Mu-kua-shan, *T. Nakamura 4377*; Taroko, *S. Sasaki* s. n. V. 25-1933; Pan-shih, *Shieh* and *Chen 757.*

Note: I am reducing *V. subclathra* to a synonym of *V. orientalis* since I see no significant differences between them. In cleared slides the cell walls show the same structure. Iwatsuki considers their smaller size and the clathrate appearance of dry specimens the outstanding characters. He states that when the inner substances of the cell are dried that they accumulate on the lateral cell walls and that this causes the distinctly clathrate appearance. Actually, the cell contents of *V. orientalis* also tends to accumulate on the lateral cell walls when they dry and often show a semi-clathrate appearance.

4. V. naseana (Christ) Ching

Ching, 1959:186; 1959a 136.

Trichomanes naseanum Christ

Christ, 1905:11; Ogata, 1928(1) pl. 46; Matsumura 1910:237; Nakai, 1926:267.

T. Somai Nakai

Nakai, 1926:267 (Type from Rimogan, Taipei Co., Collected by T. Soma).

V. radicans var. *naseana* (Christ) Ito

H. Ito, 1949:124; Ohwi, 1957:28; 1965:35; Tagawa, 1963:45.

T. radicans var. *naseanum* (Christ) Lellinger

Lellinger, 1968:157.

Rhizome widely creeping, 1 to 2 mm in diameter, covered with very long dark brown multicellular hairs; rooting at intervals; stipe 2 to 6 cm apart, winged nearly to base, about half as long as blade, 5 to 15 cm long; blades tripinnatifid, lanceolate, 18 to 40 cm long, 7 to 10 cm wide; lower pairs of pinnae often shortened; pinnae often shortened; pinnae alternate, 3–7 cm long, anadromous; stipe and rachis bearing the same type of long multicellular hairs as those on the rhizome, especially abundant on the underside at base of pinnae; wing of stipe entire or broken, plane or undulate; rachis narrowly winged; indusia tubular, only winged at base, mouth slightly enlarged, receptacle exserted.

Cellular structure: Cells polyhedral, walls thin, straight; veins mostly composed of long sclerenchyma cells, bordered by long thin walled cells, with small spiral

tracheids in the center of cach vein, and one or 2 rows of almost square brachysclereids.

Distribution: Japan, Okinawa, Taiwan, Mainland China (Kwangsi, Kwangtung, Kweichow, Szechuan, Yunnan), Hainan, Vietnam.

Taiwan:

Taipei Co., Kweishan, *Simozawa 32*; Kwang-yin-shan, *T. Nakamura 4360*; Rimogan, *T. Ito 117*; Wulai, *Feung 91*; *S. Sasaki 21534*.
Hsinchu Co., Maibarai-shan, *T. Suzuki 90203*.
Miaoli Co., Kuang-tao-shan *T. Suzuki 20090*; Tahu, *Kawakami 121*.
Taichung Co., Pa-hsien-shan, *S. Suzuki 2944*.
Nantou Co., Hoshe, *Kao 3842*; Miharasi, *S. Suzuki 10795*.
Kaohsiung Co., Buwizan, *S. Sasaki* s. n. I-5-1926; Wu-kuei-shan, *H. Matsuda 123*.
Taitung Co., Manchiashan, *Kawakami 36*; Chang-yuan, *T. Suzuki 19825*; Tamawukuchi, *S. Sasaki* s. n. II-25-1925.
Orchid Island, *S. Sasaki* s. n. VI. 3. 1926.
Ilan Co., Kan-chia-kên, *T. Ito 118*; Mt. Oobi, *Masamune* s. n. IV-25-1938; Suao, *T. Nakamura 5104*.
Hualien Co., Pan-ping to Chi-lai, *T. Nakamura 4841*; Kuai-lin to Pan-Shih, *Shieh* and *Chen 770*.

Habitat: On mossy rocks.

5. V. latifrons (v. d. B) Copel.

Copeland, 1938:56, 104; 1958:66; Tagawa, 1951:185.

T. latifrons v. d. Bosch Ned. Kr. Arch 5(3)(1938):56; Copeland, 1933:139 pl. 4.

T. cupressifolium Hayata

Hayata, 1914(4):136 fig. 73; 1915(5):260.

Isotype from Arisan, collected by B. Hayata and S. Sasaki at TAIF.

T. longifrons Nakai

Nakai, 1926:266.

Type from Arisan collected by B. Hayata. Merotype at TFI.

Rhizome filiform, 0.3 mm in diameter, covered with short dark brown hairs; stipes distant 2–3 cm long, not winged at base, winged above; fronds bipinnatfid, 8 to 35 cm long, 1 to 3 cm wide, rachis narrowly winged; indusia tubular, sunken narrowly winged, mouth somewhat expanded, receptacle exserted.

Cellular structure: Laminar cells polyhedral, walls thin and straight; marginal and submarginal row of cells have thicker walls than those of other laminar cells; veins contain 1 or 2 rows of brachysclereids, their lumen round or crescent-shaped; cells bordering the veins are elongated.

Distribution: Northern India, Bhutan, Philippines, Mainland China (Kweichow, Yunnan), Taiwan.

Taiwan:

Taipei Co., Rimogan, *T. Ito* s. n. XI. 3. 1914.
Chiayi Co., Arisan, *B. Hayata* IV. 19. 1914.
Ching (1959: 172) places this species in the genus *Crepidomanes*.

Note: Ching places *T. latifrons* in the genus *Crepidomanes* and I do not know why. I have seen no false veins in any specimens from Taiwan. It would seem that on account of their thicker walled marginal cells this species could be transferred to the genus *Crepidophyllum* (*Crepidopteris*) or to the section Crepidium as recognized by Christensen and Morton.

But in *T. latifrons* the marginal cells have their radial walls nearly perpendicular to the margin, while in all known species of *Crepidophyllum* the marginal cells have very oblique radial walls.

6. V. pyxidifera (L.) Copel.

Copeland, 1938:53; Masamune, 1954:5.

Trichomanes pyxidiferum Linn.

Linnaeus, 1753:1098; Copeland, 1933:132: Nakai, 1926:265; Slosson, 1915:651–658 pl, 30.

Rhizome widely creeping, filiform, 0.3 mm in diameter, covered with a mass of multicellular dark-brown hairs; fronds distant; stipes 4–10 mm long, wingless below, winged above; fronds bipinnatifid, usually 4–8 cm long, occasionally longer, 1.5–2 cm broad; bearing clavate, glandular hairs on the veins; rachis broadly winged; sori one per pinna borne on first acroscopic vein; indusia short, cone-shaped, sunken in frond; mouth rounded, somewhat enlarged but not suddenly flaring; receptacle exserted.

Cellular structure: Cells polyhedral, small; walls thin, straight; marginal cells longer and stain darker than the other cells of the lamina, veins with at least one row of brachyscleids, center of vein with spiral tracheids, margins of veins with linear, thin walled cells.

Note: Morton (1968:183) placed this species tentatively in the section *Crepidomanes*. I am not sure why, I have seen no false veins in any specimens collected from Taiwan, but I have seen very few specimens from other places.

Copeland (1933:131) placed the *T. pyxidifera* group in a separate section, then in 1938 he merged this group with the *T. radicans* group (1933:212) and called the new genus *Vandenboschia.*

Morton has indicated that he considers *T. pyxidifera* as not belonging in section **Lacosteopsis** and tentatively placed it in the section **Crepidomanes.** Ching transfered *T. latifrons* to *Crepidomanes.* I cannot see why either should be in *Crepidomanes* but I think they are right in removing these species from Copeland' *Vandenboschia.* However I am not transfering either to any other genus or section at this time. I believe more study is needed before we further confuse the issue by the multiplication of names.

Distribution: Tropical America, Africa, Taiwan.

Taiwan:

Ilan Co., Nan-hu-ta-shan, *G. Masamune 3062*; Ssuchi, *S. Suzuki 65.*

Hualien Co., Mukua-shan, *T. Nakamura 4455*; Taroko, *S. Sasaki* VI. 11, 1933; Neng-kao-shan, *T. Nakamura 5056*.
Chiayi Co., Mt. Ali, *B. Hayata* and *S. Sasaki 99*.
Taichung Co., Ta-hsuch-shan, *Shieh 944*.

Note: As pointed out by Slosson (1915:651–658 pl. 30, 31) this is not the same species as described and figured by Hooker and Greville (1831 pl. 206): however whether or not our Taiwan plants are identical with those from the West Indies, I cannot be positive, since we do not have American ferns of this species in our herbarium. But judging by the illustrations and descriptions the two appear to be the same.

(7. **V. parva** Copel)[1]

Copeland, 1938:53.

Trichomanes parvum Copel.

Copeland, 1933:134

Rhizome filiform covered with dark brown hairs; frond 2.5 to 3 cm tall, 1.5 cm broad, bipinnatifid; rachis winged; without false veins; sori borne on the acroscopic side of pinnae, indusia tubular, mouth expanded, receptacle exserted.

Distribution: Taiwan

Taiwan:

Hwalien Co., Kuai-lin to Pan-shih, *Shieh* and *Chen* IX. 9. 1968.

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(1) **Note:** Iwatsuki (1958: 70) considers this a stunted form of *V. orientalis* and he is probably correct.

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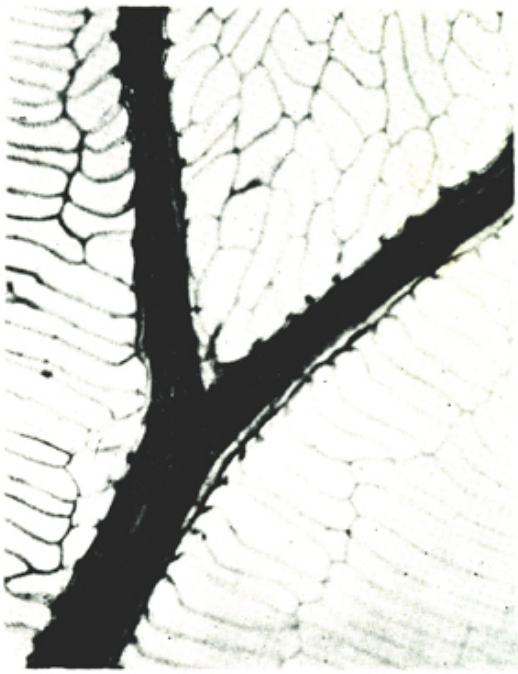
INDEX

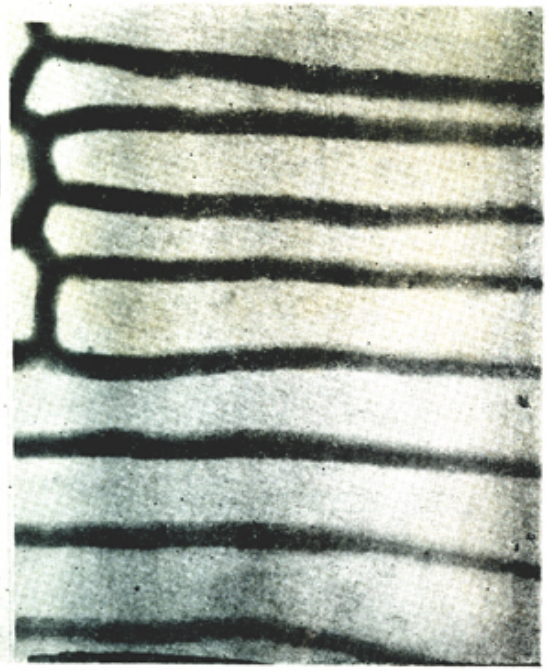
(Synonyms in italics.)

Abrodictyum
cumingii Pr. 102
Callistopteris
apiifolia (Pr.) Copel. 100
baueriana (Emdl.) 100
Cephalomanes
acranthum (H. Ito) Tagawa 98
auriculatum v. d. B. 119
javanicum (Bl.) v. d. B. 98
oblongifolium Presl 98
Craspedomeuron
pallidum v. d. B. 117
Crepidomanes
bilabiatum (Nees and Bl.) Copel. 104
humile (Forst.) v. d. B. 109
late-alatum (v. d. B.) Copel. 105
late marginale (Eaton) Copel. 106
makinoi (C. Chr.) Copel. 105
nanophyllum Tagawa 107
palmifolium (Hayata) DeVol 108
tagawanum Iwatsuki 105
Crepidophyllum
humile (Forst) Reed 109
Crepidcpteris
humilis (Forst) Copel. 109
Didymoglossum
late-alatum v. d. B. 105
Gonocormus
minutus (Bl.) v. d. B. 113
Habrodictyon
cumingii Pr. 102
Microgonium
beccarianium (Cesati) Copel. 110
bimarginatum v. d. B. 111
motleyi v. d. B. 111
omphalodes Vieillard 112
Microtrichomanes
nitidulum (v. d. B.) Copel. 115
Nesopteris
grandis Copel 102
thysanostoma (Makino) Copel. 101
Pleuromanes
pallidum (Bl.) Presl 117
Selenodesmium
obscurum (Bl.) Copel. 95
Trichomanes
acranthum H. Ito 98
acutum Makino 105
apiifolium Pr. 100
asplenoides Presl 98
auriculatum Bl. 119
bauerianum Endl. 100
beccarianum Cesati 111
bilabiatum Nees et Bl. 104
bimarginatum v. d. B. 111
bipunctatum var. plicatum Bedd. 105
blepharistomum Copel. 101
cumingii (Pr.) C. Chr. 102
cupressifolium Hayata 124
cupressoides Desv. 95
filiculum Bory 105
formosanum Yabe 106
grande Copel. 102
humile Forster 109
insigne Beddome 105
japonicum Fr. et Sav. 121
javanicum Bl. 98
kalamocarpum Hayata 121
kurzii Bedd. 106
late-alatum (v. d. B.) Christ 105
late:marginale Eaton 106
latifrons v. d. B. 124
liukiuensis Yabe 120
longifrons Nakai 124
makino (C. Chr.) Copel. 105
maximum Bl. 120
minutum Bl. 114
miyakei Yabe 120
motleyi v. d. B. 111
nanophyllum (Tagawa) Morton 107
nanum Hooker and Baker 106
naseana Christ 123
nitidulum v. d. B. 116
pallidum Bl. 117
palmifolium Hayata 108
parvulum Poir. 114
peltatum Baker 112
pyxidiferum Linn. 125
obscurum Bl. 95
omphalodes (Vieillard) C. Chr 112
orbiculatum Ching 114
radicans Swz. 121
var. *orientalis* (C. Chr.) Lell 121
var. *naseanum* (Christ) Lell 123
rigidum (non sw.) Hooker 95
saxifragoides Presl 114
somai Nakai 123
thysanostoma Makino 101
Vandenboschia
auriculata (Bl.) Copel. 119

latifrons (v. d. B.) Copel. 124
liukiuensis (Yabe) Tagawa 120
maxima (Bl.) Copel. 120
naseana (Christ) Ching 123
orientalis (C. Chr.) Ching 121
parvum Copel 126
pyxidifera (L.) Copel. 125
radicans (Sw.) Copel. 121
var. *naseana* (Christ) H. Ito 123
var. *orientalis* (C. Chr.) H. Ito 121
subclathra 121



1. Abrodictyum cumingii *Nakamura 3571.* From Hualien Co. Laminar cells transverse to veins.

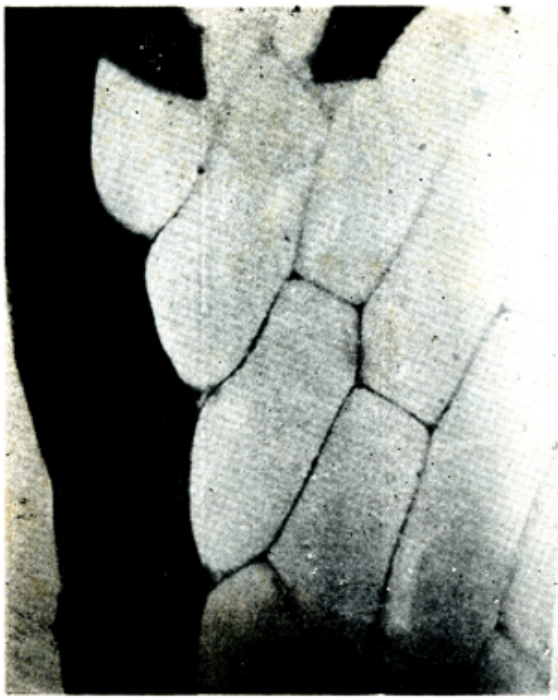


2. Abrodictyum cumingii *Nakamura 3571.* Lamina cells with smooth walls.

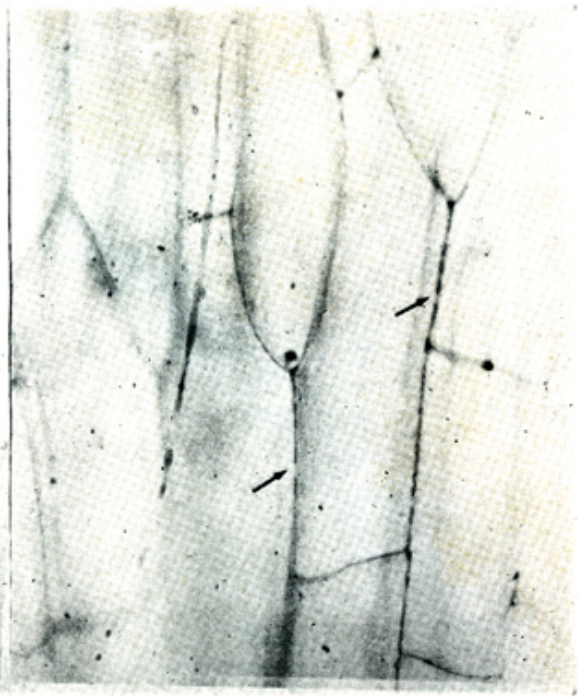
3. Callistopteris apiifolia *Kao 5972.* From Ilan Co. Cells bordering veins with simple pits.

4. Cephalomanes javanicum *T. S. Liu 398.* From Orchid Island. Lamina cells with wavy walls.

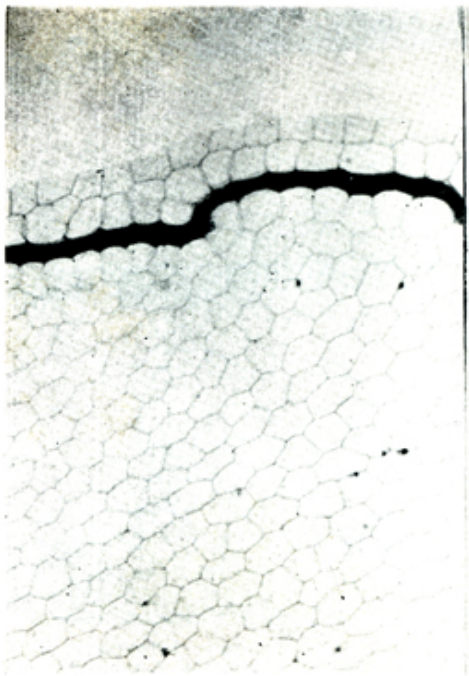
Plate 13



1. Pleuromanes pallidum *T. Suzuki18189.* From Taipei Co. Row of submarginal cells thick-walled and deeply staining. Not made up bracysclereids.



2. Pleuromanes pallidum *T. Suzuki 18189.* Parenchyma cells bordering the veins have thin walls with simple pits.



3. Crepidomanes latemarginale *T. Suzuki 19431.* From Taitung Co. Submarginal vein continuous made up of brachysclereids

4. Crepidomanes latemarginale *T. Suzuki 19431.* Enlarged view of brachysclereids.

Plate 14